

The World of "Septic Vapours:" Yellow Fever and United States Shipping, 1798-1905

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Dans les années 1800, les marins nord-américains craignaient la fièvre jaune. On se demandait notamment d'où provenait la maladie. Plusieurs chirurgiens et agents de santé américains en étaient venus à la conclusion que la fièvre se transmettait spontanément à partir des toilettes des navires circulant dans les mers subtropicales et tropicales. On prit ainsi des mesures pour que le ballast et les ponts inférieurs demeurent propres et secs. On considérait de plus que le froid et la chaleur humide élimineraient le virus. Par conséquent, les officiers de marine recherchaient les eaux plus froides de la Nouvelle-Angleterre pour neutraliser le soi-disant fléau naval. Cet essai examine la polémique entourant la question et les mesures de prévention prises par les autorités médicales pour empêcher les navires militaires et marchands de devenir des vaisseaux d'incubation du pathogène mortel.

Few occurrences terrified hardy American seamen like a yellow fever outbreak. This horrific disease claimed the life of Commodore Oliver Hazard Perry and ended the promising careers of many officers. An episode in Hampton Roads on board the USS *Constitution* during the autumn of 1798, described by Midshipman John Roche, Jr, typified this gloomy sense of mariners waiting for their lives to be cut short. Roche recorded "the prospect was melancholy, scarce a minute, but some one was taken down on a sudden, [sic] No one could tell when it would be his turn & the stillness of the grave prevailed. We could not put to sea, as most of the officers were down & our surgeon dead."

Interest in the history of yellow fever has risen at a time when imported vector mosquitoes, such as the Asian tiger mosquito and diseases, such as West Nile Fever, monkey pox, and SARS have appeared across North America. Recent yellow fever studies have focussed on the regional, public health, and political facets of the fever. Scholars, however, merely mentioned the maritime association of yellow jack and consequently have ignored

¹ Christopher McKee, ed., "Constitution in the Quasi-War with France: The Letters of John Roche, Jr., 1798-1801," *American Neptune*, 47 (April 1967), 140, 141.

a rich body of sources. Using many of these untapped resources, this essay will explore the American belief in the spontaneous generation of yellow fever on board ships as well as ships as carriers of disease, the measures taken to eliminate the fever, relevant innovations and policies, and efforts to protect crews and passengers.²

In North America, the urban-dwelling *Aedes (Stegomyia) aegypti* mosquito was the vector that carried this smallest of viruses to humankind after the insect contracted yellow fever from other humans. The female mosquitoes sought a blood meal for the nutrients needed to ovulate. While the vector was often indigenous, the virus was transported via mosquitoes or the sick on board ships to distant seaports. In cooler weather the mosquito did not lay eggs and therefore, did not seek a blood meal. Most scientists link the pathogen to the African slave trade and point to the resistance of African Americans to the illness as proof. In the twenty-first century, the fever remains a threat in Africa and South America.³

As early as the 1647, Massachusetts Bay Governor John Winthrop recorded what may have been a yellow fever outbreak from Barbados. Similar evidence also suggests that the scourge appeared in the mid-1600s in Florida and New York. As with other epidemical illnesses, intense political, naval, demographic, and commercial activity perpetuated the appearance of yellow fever. The influx of European immigrants and indentured servants provided fresh victims from which the mosquitoes contracted the microbe. Wars, revolts, and the importation of enslaved Africans also created population influxes.⁴

This interaction was the conduit that sparked a series of outbreaks in the New

¹ Some of these monographs are: Khaled J. Bloom, *The Mississippi Valley's Great Yellow Fever Epidemic of 1878* (Baton Rouge and London, 1993); Margaret Humphreys, *Yellow Fever and the South* (New Brunswick, NJ, 1992); Jo Ann Carrigan, *A History of Yellow Fever in Louisiana, 1796-1905* (Lafayette, LA, 1994); John H. Ellis, *Yellow Fever and the New South* (Lexington, KY, 1992); Arthur Goldhammer's translation of François Delaporte's, *History of Yellow Fever: An Essay on the Birth of Tropical Medicine* (Cambridge, MA and London, 1991); J. Worth Estes and Billy G. Worth, eds., *The Public Response to the 1793 Philadelphia Yellow Fever Epidemic* (Canton, MA, 1997); and Charles S. Bryan, *A Most Satisfactory Man: The Story of Theodore Brevard Hayne, Last Martyr of Yellow Fever* (Spartanburg, SC, 1996). In 1993, the University of Pennsylvania Press reissued with a new introduction J.H. Powell's *Bring Out your Dead: The Great Plague of Yellow Fever in Philadelphia in 1793*. Finally, the writer of this article has written a brief history titled *Fearful Ravages: Yellow Fever in New Orleans, 1796 to 1905* (Lafayette, La., in press) to be published by the University of Louisiana at Lafayette as part Louisiana Life series.

Works that mention the fever in their titles but offer few details of the disease are: Duncan Crewe, *Yellow Jack and the Worm: British Naval Administration in the West Indies, 1739-1748* (Liverpool, 1993) and Christopher Wills, *Yellow Fever, Black Goddess: The Coevolution of People and Plagues* (Reading, MA and other cities, 1996). The last work was originally released in Great Britain under the more aptly title of *Plagues: Their Origins, History and Future*. Within this group of books with references to yellow fever in their respective titles is, *Yellow Flag: The Civil War Journal of Surgeon's Steward C. Marion Dodson* (Baltimore, 2002) edited by Charles A. Earp. Dodson covers the yellow fever in a naval context but that was not the thrust of his journal.

At the completion of this article there was a debate in the scientific community concerning the possibility of changing the name of the yellow fever mosquito from *Aedes aegypti* to *Stegomyia aegypti*. In this article the traditional name is used.

³ Gordon McPherson, ed., *Black's Medical Dictionary* (Lanham, MD, 1999), 594-595; and Kenneth F. Kiple, ed., *The Cambridge World History of Human Disease* (Cambridge, Eng. and New York, 1993), 592-593, 1102.

⁴ James Kendall Hosmer, *Winthrop's Journal: "History of New England," 1630-1649* (New York, 1908): 1,329-330; and James Truslow Adams, *Dictionary of American History* (New York, 1940): V, 504.

England the towns of Newburyport, New London, Knowle's Landing, Portsmouth, and Middletown. Dr William Tully recorded that the exodus from Knowle's Landing was "so great that Sarah Exton [a fever sufferer] was left alone in the night, and was found dead in the morning, with her infant child at her breast." The fever also struck the medium-sized ports of New Haven, Norfolk, Charleston, and New Orleans, and larger cities such as Boston, New York, and Philadelphia.⁵

In the 1790s, Philadelphia the infant nation's capital, endured a series of devastating epidemics. After each outbreak of yellow jack, solons discussed the fever's cause, predisposition, and cures. To control the plague, concerned parties offered a plethora of ideas about prevention and origination of the fever. Discussions were emotionally charged and characterized by finger pointing. In the thick of these arguments, Dr Lyman Spaulding of New York poignantly noted that in "truth, pestilence is a child of many fathers, but disowned by them all." Naturally, the epidemics caught the attention of William G. Chalwill and his fellow medical students. Completing one of the requirements for graduation, Chalwill published his dissertation. He opened his thesis on yellow fever with the observation that "the noxious air discharged from putrefying animal and vegetable substances contained in the holds of the ships. A considerable source of yellow fever, which devastated in the south-eastern part of Philadelphia, in the year 1797, was attributed to the foul air emitted from the snow *Huldah*:"

The concept of yellow fever was so intertwined with shipping that many assumed that ships bred the pestilence. Like other aspects of yellow fever, there were gradations of opinion on this particular issue. Dr Thomas Y. Simons, the port physician of Charleston, called the yellow fever arguments a "maze of controversial sophistries." Doctors and the enlightened masses debated whether the fever emanated from rotting green ship timbers, from decaying vegetable and/or animal matter, or from a combination of the three. In addition, factors such as humidity, cleanliness, moisture, constant high temperatures, and the predisposition of the sufferers to contract the disease were also bones of contention of the verbal milieu. The debate as to whether the conditions on a vessel's filthy lower decks were the only breeding place for fever or whether could these conditions be recreated in port also

⁵ Kiple, *History of Human Disease*, 1103-1105; John B. Beck, "A Report to the New-York Board of Health, concerning the nature of the Malignant Fever in Middletown, Connecticut; Presented on the 17th of July, 1820," *New-York Medical and Physical Journal*, 1 (April, May, and June, 1822), 158; William Tully, "History of the Yellow Fever as it occurred at Knowle's Landing, Connecticut, in a letter to David Hosack, M. D.," *New-York Medical and Physical Journal*, 1 (April, May, and June 1822), 153, 155; John B. Blake, "Yellow Fever in the Eighteenth Century America," *Bulletin of the New York Academy of Medicine*, 44 (June 1968), 673-675; and J. Worth Estes and David M. Goodman, *77æ Changing Humors of Portsmouth: The Medical Biography of an American Town, 1623-1983* (Boston, 1986), 6, 17, 142-145.

⁶ Lyman Spaulding, *Reflections on Yellow Fever Periods: or Particular Investigation of the Long Contested Question, whether the yellow fever can originate amongst us; or, is always imported from abroad* (New York, 1819), 16; and William G. Chalwill, *A Dissertation on the Sources of Malignant Bilious, or Yellow Fever, and means of preventing it: submitted to the Examination of the Rev. John Ewing, S.T.P. Provost: the Trustees & Medical Faculty, of the University of Pennsylvania, On the sixth Day of June, 1799, for the Degree of Doctor of Medicine* (Philadelphia, 1799), 1.

received attention. Borrowing from these varied points of view, naval Surgeon Usher Parsons concluded, the fever "arises from the foul air of a ship, either from infectious effluvia, or from putrefaction that takes place on neglected holds. A fit of intemperance, or too much exercise in the heat of the sun, serves to hasten its attack."⁷

Following that same line of thinking, a few years later, a published letter complained of the poor preservation properties of manufactured salt. The author concluded that "the employment of Liverpool salt, in the pickling of beef, leaves it liable to corrupt; and the consequences of this corruption are pestilential exhalations stirring up yellow fevers and other malignant distempers in the neighborhoods, cities and vessels where the bodies of these herds of slaughter meat cattle happen to be deposited."⁸

As long as American merchantmen operated in the warmer Atlantic waters, the US Navy was called upon to protect these commercial interests. The warship crews were extremely vulnerable to outbreaks of fever because a vessel's complement of men was often eight times higher than that of a merchant vessel of comparable tonnage. High numbers of non-immune men living in very close quarters on the orlop deck were the prime victims. Also, many of these mariners hailed from New England and Europe, and had never been exposed to the fever as children.⁹

For example, in June 1799, the USS *General Greene* sailed from Havana. In port, fever had consumed an unfortunate few. The frigate left Cuba, escorting a merchant fleet. Once underway, yellow jack continued its rampage; among the twenty deaths of the forty cases were the frigate's surgeon and purser. The fever was so consuming that the survivors did not keep proper mortality records. When the *General Greene* returned to Newport,

⁷ Thomas Y. Simons, "An Essay on the Yellow Fever, as it occurred in Charleston, including its origin and progress up to the present time," *Edinburgh Medical and Surgical Journal*, 78(1 October 1852), 263; René La Roche, "Facts and Observations on the Origin of Yellow Fever from Local Sources of Infection, as illustrated by Occurrences on board of Ships," *American Journal of the Medical Sciences*, 32 (April 1853), 316-355; T.S. Bell, "What is Yellow Fever?" *Louisville Medical News*, 6 (24 August 1878), 85; William Fergusson, "An Inquiry into the Origin and Nature of the Yellow Fever, as it has lately appeared in the West Indies," *Medico-Chirurgical Journal and Review*, 4 (December 1817), 492; Spaulding, *Reflections on Yellow Fever*, 15-21; Usher Parsons, *Physicians For Ships: Containing Medical Advice for Seaman and other Persons at Sea, on Treatment of Diseases, and on the Preservation of Health in Sickly Climates, and also on California* (Boston, 1851), 19; and "Yellow Fever," *Naval Chronicle*, 10 (July to December, 1803), 470. Although a British publication, this last source cited an unnamed American chemist's claim "that the infection proceeds principally from the effects of gas arising from animal putrefaction."

⁸ [Letter from Dr Mitchill to Charles Caldwell], "Illustrations of the Spoiling of Beef, Pork, and Butter, when cured with Liverpool Salt; and of the Fevers excited thereby, as those corrupting Articles act directly upon the Stomach and Intestines, and through the Medium of the Atmosphere upon other Parts of the Body, in private Houses in Ships and in Cities in a Letter from Dr Mitchill to Charles Caldwell, M. D. &c dated Washington, Oct. 22, 1803," *Medical Repository*, 1, [2d Hexade] (November, December 1803 and January 1804), 244.

⁹ Delavan Bloodgood, "An Account of the Yellow Fever Which Appeared in December, 1866, and Prevailed on board the United States Ship Jamestown, Store and Hospital Ship at Panama," in *Medical Essays: Compiled from Reports to the Bureau of Medicine and Surgery*, (Washington, DC, 1872), 185-186; and Harold D. Langley, *A History of Medicine in the Early U.S. Navy* (Baltimore and London, 1995), 61-71, 77.

Rhode Island, the fever spread to some of the inhabitants, alarming the populace.¹⁰

Civilian doctor Lemuel Kollock of Savannah described the questionable condition of the frigate. "She was... leaky. Having been caulked in winter, her seams opened as the warm weather advanced. Her ballast consisted partly of iron and partly of earth, taken from a clay shore. This was intermixed with soft slate-stone, shells, and marine vegetables.... The ship was furnished with one ventilator, and wind sails." Kollock concluded "The principle of disease seemed to have been generated on board, and to have gradually acquired virulence and activity as they approached the place of their destination."¹¹

To counter these conditions navy surgeons, port officials, and physicians offered recommendations ranging from ventilation and fumigation, to chemical baths and a change of course to cooler waters. In 1795, the well-known yellow fever physician Benjamin Rush touted a "machine" invented by fellow Philadelphian Benjamin Wynkoop that reportedly "moved by the constant motion of the sea in all weathers, for pumping water and foul air out of ships and thereby preventing a great source of the calamities to which seaman are exposed." Wynkoop's ventilator also received the endorsement of the city's Academy of Medicine.¹²

This focus on ships as the fever's source and the need for ventilators was often stated in the boldest of terms. In 1805, Doctors Samuel Latham Mitchill and Edward Miller, editors of *The Medical Repository*, pinpointed the problem and a source of controversy when they declared "It is deplorable that so much injury should be inflicted in consequence of a single error.... THE MISTAKING THE GENERATION OF FEBRILE POISON IN FILTHY VESSEL, FOR THE IMPORTATION OF CONTAGION FROM FOREIGN COUNTRIES." Essentially, the editorial pair concluded that the ships were the seedbed of the fever and not the vessel's last port of call. This meant that untidy ships should be thoroughly cleansed, and quarantines and trade restrictions should not be directed at the infected ship's ports of call.¹³

During the 1820s in the Gulf of Mexico, Assistant Surgeon Samuel Barrington of the USS *Grampus* and USS *Hornet*, supported safeguards to prevent the generation of the fever poison. The regimen involved the use of pumps to circulate air below decks and the flushing a mixture of water and chloride of lime through the chain lockers. Sailors also turned to and applied several coats of white wash to their infectious ships. They aired their bedding and burned the clothing of victims. Burial details also disposed of the remains of

¹⁰ Edmund Thomas Waring, "Account of the Yellow Fever which originated on Board the United States Ship General Greene," *Medical Repository*, 4 (1801), 234-237; and L. Kollock, "An Account of a Malignant Disease which appeared on board the United States Frigate General Greene: In a Letter from Dr L. Kollock, of Savannah, in Georgia, to Dr Miller," *Medical Repository*, 4 (1801), 2.

"Kollock, "Malignant Disease," 2-3.

¹² L.H. Butterfield, ed., *Letters of Benjamin Rush* (Princeton, NJ, 1951): II, 761-762. Rush became the centre of a medical turmoil, in part, because he advanced aggressive treatment of the fever which included bleeding the patient, inducing puking, and heavy doses of mercurial-laced medicines.

¹³ [Samuel Latham Mitchill and Edward Miller], "Preface," *Medical Repository*, 2d Hexade, 2 (1805), vii.

the deceased as quickly as possible.¹⁴

The situation pertaining to the fever became so deplorable on land and sea that in 1822, Alexander Coventry, a Utica, New York physician and lawyer, declared the disease was "the Plague of the Western Continent." Three decades later the fear remained. Surgeon Parson echoed that the "mere name yellow fever is sufficient to damp the spirits of sailors." For the general public, *Harper's New Monthly Magazine* painted the gruesome scene faced by crew members on a ship infected with no possibility "of escaping to a healthier climate. The pestilence barred their exit, as if to consume their inmates at its leisure."¹⁵

There were no further major epidemics in the Northeast after the 1820s but the fever still threatened the cities. This may have been due in part because the *A. aegypti* mosquito is not indigenous to this region of North America. Nevertheless, infected sailors quarantined at lazarettos and marine hospitals sparked scares, spawned outbreaks, and served as reminders of the devastating effect of the fever. For instance, in 1853, the *Sheffield* arrived at quarantine in Boston from New Orleans with one dead man, and "one or two sick" with the fever. After yellow fever made the USS *Susquehanna* "a floating charnel-house," she arrived in New York. These vessels with infectious naval and merchant crews made observers anxious about the filthy conditions in the city. A reporter predicted that "Yellow fever in New York would create a wide-spread alarm, paralyse business, desolate families and demoralize our commercial organizations to an extent that cannot be realized." These occurrences also created fever scares in Portsmouth, New Hampshire during the Civil War and two panics in 1853 and 1870, in Philadelphia. Southerners were even less fortunate. The fever ravaged Southern cities until the final epidemic in 1905, which struck New Orleans.¹⁶

One can measure yellow fever's omnipresence and impact on the maritime world by examining a few of the more than one hundred and fifty names and phases that describe the illness. Colourful monikers, in both the literal and figurative sense, such as bronze John, *vomito negro*, yellow jack, the stranger's disease, and the saffron scourge tell the tale of the fever's aura. Frequently, the complexion of fair-skinned people acquired a yellowish hue also described in mahogany, pumpkin, and orange tints. *Vomito negro* was a Spanish descriptor drawn from the symptom of regurgitating partially digested blood. Occasionally, yellow fever was referred to as ship fever, although this more often pertained to typhus. Many immigrants contracted the virus, so Creoles dubbed the ailment the stranger's disease. And quarantine officials required ships with sick passengers and crews to fly a yellow flag (jack), thus the name yellow jack. Despite the isolation, infectious mosquitoes and crew

¹⁴ *Official Records of the Union and Confederate Navies in the War of the Rebellion* (Washington, DC, 1898): Series I, Vol. 27, 593 (Hereinafter, all references refer to Series I); and Samuel Barrington, "Facts and Observations relative to the Disease commonly called Yellow Fever as it Appeared on Board the United States Ship Hornet in 1828, the United States Schooner Grampus in 1829 and the United States Hospital Pensacola in the Cases received from the Peacock, in 1830," *American Journal of Medical Sciences*, 12 [handwritten notation corrected to volume 26] (August 1833), 307-310.

¹⁵ "Yellow Fever," *Harper's New Monthly Magazine*, 15 (June 1857), 65; Parsons, *Physicians For Ships*, 20.

¹⁶ Benjamin H. Trask, "Yellow Fever and Its Effects on Southern American Ports, 1850 to 1905," *Mariners' Museum Journal*, 2d Series, 2 (1996), 45-48; "Yellow Fever," *Frank Leslie's Illustrated Newspaper*, 5 (24 April 1858); and *New York Herald*, 2 September 1853.

members transported by these pest ships carried the virus to portside towns.¹⁷

The efforts to check the fever required constant attention. Therefore, naval medical officials advocated cleaning the ship with water only during intervals of fair weather, keeping the water from gathering in the hold, and using pumps to empty the vessel of any water that has accumulated twice a day. Surgeons were not the only officers with ideas on how to keep men healthy. While on the USS *Constitution* off the African coast, Captain John Rudd ordered the "cinders from the coal at the gallery... put in hanging stoves about different parts of the deck" to keep the moisture levels low.¹⁸

During the Mexican War (1846-1848) the US Navy's Home Squadron served in the Gulf of Mexico with the dual mission of closing ports and suppressing blockade running. In the summer of 1847, yellow fever immobilized the fleet. The squadron's medical staff was depleted, the commodore contracted the disease, and firemen and coal heavers were laid low. The illness of the later prevented the infected vessels from steaming north to cooler climates. To cleanse his ship, the surgeon of the USS *Vixen* sealed the vessel's ports and hatches and generated heat with the boilers to create a pressure cooker-like environment. In the end, the heat exterminated rats and roaches, and ruined the woodwork. However, it was the mosquito not the cockroach that was the menace.¹⁹

The following two passages illustrate the association between mosquitoes and water craft. Federal navy surgeon Civil War Samuel Pellman Boyer served on the USS *Fenandina* while blockading the coast of Georgia during the American Civil War. On 8 June 1863 the doctor penned in his journal: "The weather today is somewhat cooler than what it was yesterday. Quite a breeze is blowing. Thermometer 74° Fahr. The change in the weather has caused one of the greatest torments that was ever sent to afflict man for his iniquities in the world, the mosquito, to skedaddle. The tribe of tormentors began to swarm with the returning heat of the season in April and continue their annoyance till they are stiffened and benumbed by the cold of November."²⁰ Almost fifty years later in his book *Sailing Alone Around The World*, Joshua Slocum, New England's solo circumnavigator, penned the following passage that exemplified how the insects bred and fed on sailors on the high seas: "... no living thing disturbed my solitude; no insect was present in my vessel.... Nothing, I say, till sailing down the last stretch of the Indian Ocean, where mosquitoes came by the hundreds from rain-water poured out of heavens. Simply a barrel of rain-water stood on deck for five days, I think, in the sun, then music began. I knew the sound at once; it was the same as heard from Alaska

¹⁷ McPherson, *Blacks 'Medical Dictionary*, 594; Herbert L. Tindall, "Yellowjack and The Conchs: The Impact of Yellow Fever on Key West," *Florida Keys Sea Heritage Journal*, 2 (Spring 1992), 1; and Phyllis Allen, "Etiological Theory in America Prior to the Civil War," *Journal of the History of Medicine*, 2 (Autumn 1947), 489-496.

¹⁸ E. H. Barton, *The Causes and Prevention of Yellow Fever at New Orleans and other Cities in America* (New York, 1857), 84.

¹⁹ K. Jack Bauer, *Surfboats and Horse Marines: U.S. Operations in the Mexican War, 1846-1848* (Annapolis, MD, 1969), 24, 124-126.

²⁰ Elinor Barnes and James A. Barnes, eds., *Naval Surgeon Blockading the South, 1862-1866: The Diary of Samuel Pellman Boyer* (Bloomington, IL, 1963), 128.

to New Orleans."²¹

In the spring of 1858, Passed Assistant Surgeon Robert T. Maccoun of the *Susquehanna* experienced a medical nightmare. The first fatal case of yellow fever struck while the frigate anchored off San Juan, Puerto Rico. The ship steamed away from the island to shake the grip of the fever, but the virus continued to flourish. In the end, there were 170 cases of fever out of a total complement of 300 individuals; 46 of the sick died. Maccoun reported these classic observations. When the ill-fated vessel headed for home, "it being evident that the ship was infected with a malarious poison, which could not be eradicated." In addition the surgeon remarked, high temperatures caused "all kinds of animal and vegetable matter [to] quickly decompose... Everything in the ship was saturated with moisture, even the bedding.... [Furthermore, there were] parts of a ship out of sight which, under the present mode of construction and arrangement of the hold, cannot be got at unless she is thoroughly *broken out* and the floor taken up, so as to expose bilge limbers."²²

At the same time, New Orleans resident and architect Thomas K. Wharton was ever watchful of the health conditions in the city. He noted in his journal "some [recent] cases of yellow fever in the Charity Hospital, traced to the shipping. It is not unlikely that the confined hold of a vessel lying at the Levee might generate the disease during the summer months of this latitude even without communication with a sickly tropical port." During the Civil War (1861-1865), this deadly Southern plague weighed heavily on the minds of federal leaders. Although outbreaks of fever were relatively minor compared to the Antebellum levels the fear of yellow jack loomed mightily.²³

After New Orleans fell to Union forces in the spring of 1862, Union Major General Benjamin F. Butler ordered a strict quarantine. The general paid considerable attention to municipal sanitation and the inspection of incoming ships, cargoes, crews, and passengers. The general's father had died of the fever, and he was determined to protect his vulnerable troops in a city justifiably known as the "Necropolis of the South." Butler ultimately saw the quarantine as a protective measure against "a vessel loaded with hides and wool, the absorbents of the malaria with a filthy hold, reeking with dead and putrid organic matter, loaded at an infected port, infected hands, sown thick with the seeds of disease, only waiting for a time and the warm sun to develop them into a plague."²⁴

Duty once again called for the US Navy to maintain vessels in the Gulf of Mexico in the course of their duties. The navy offered covering fire for the landings along the Southern coast. The South Atlantic Blockading Squadron isolated the enemy's ports from ocean-going shipping. The federal navy also intercepted Confederate blockade runners

²¹ Joshua Slocum, *Sailing Alone Around The World* (New York, 1900), 258.

²² Robert Maccoun communicated by W. Whalen, "Account of Yellow Fever, as it occurred on board the US Frigate 'Susquehanna' in March and April 1858," *American Journal of Medical Sciences*, New Series, 35 (October 1858), 324, 326.

²³ K. David Patterson, "Yellow Fever Epidemics and Mortality in the United States, 1693-1905," *Social Science & Medicine*, 34 (April 1992), 858; Samuel Wilson, et al., eds. *Queen of the South, New Orleans, 1853-1862: The Journal of Thomas K. Wharton* (New Orleans and New York, 1999), 88.

²⁴ Jo Ann Carrigan, *The Saffron Scourge*, 49; Benjamin F. Butler, *Private and Official Correspondence of Gen. Benjamin F. Butler* (Norwood, MA, 1917): II, 340-341.

operating from Caribbean islands and neutralized rebel cruisers that hunted American merchant ships in these seas. These missions, therefore, required the sailors and marines to be constantly exposed to the fever.

To help the Union navy maintain its effectiveness, in April 1862, Secretary of the Navy Gideon Welles directed that the "approach of the sickly season upon the southern coast of the United States renders it imperative that every precaution should be used by the officers commanding vessels to continue the excellent sanitary condition of their crews. The large number of persons known as contrabands flocking to the protection of the United States flag affords an opportunity to provide in every department of a ship, especially boat crews, acclimated labor." Welles's orders underlined two common assumptions. The first presumed that clean, well-ventilated ships curbed the presence of diseases. The second assumption was that African-Americans had a strong resistance to fevers. This second pronouncement was well-founded, as some blacks did have a resistance to yellow and malarial fevers.²⁵

During the war, naval ships often headed northward after yellow fever erupted onboard. On 1 August 1862, Commander William Ronckendorff directed the infected USS *San Jacinto* of the East Gulf Blockading Squadron from Key West to Boston. At the quarantine grounds near the Deer Islands the inflicted sailors recovered. In dark contrast, in that same month the complement of the USS *R.R. Cuyler* of the same squadron did not fare as well. The commanding officer, Francis Winslow and others were seriously ill with fever. The ship's surgeon concluded that the only chance for the sick to survive was for the *Cuyler* to "proceed north." The ship reached New York but not before the captain died. The fever also appeared on other ships of the squadron. Harried by yellow jack, the squadron's flag officer James L. Lardner confronted an adversary more lethal than the Confederates. In the midst of this pestilence, Union Assistant Secretary of the Navy Gustavus Vasa Fox acknowledged in a letter to the flag officer that "death in its most appalling form surround[s] you."²⁶

The Confederates had their own frightening encounters with yellow fever. The minor, antebellum seaport of Wilmington, North Carolina grew in importance to the Confederates as the federals captured outright or choked by the blockade other southern harbors. Wilmington, however, protected by the treacherous currents and bars along the Carolina coast remained a viable port of entry for European manufactured war materiel, medical supplies, and household goods. In the summer of 1862, the blockade runner *Kate* introduced yellow fever from Nassau to the citizens of Wilmington and consumed 700 lives before the epidemic subsided.²⁷

In response, officials ordered vessels from the West Indian ports with yellow fever into quarantine despite the desperate need for imported military hardware. In quarantine, the vessel, crew, and cargo were held in isolation. One solution to this predicament was to use

²⁵ Todd L. Savitt, *Medicine and Slavery: The Diseases and Health Care of Blacks in Antebellum Virginia* (Urbana, IL, 1978), 25-28, 41, 240-244; and *ORN*, Vol. 7, 294.

²⁶ *ORN*, Vol. 17, 296-297, 304-305, 310-313.

²⁷ Benjamin H. Trask, "Yellow Fever in Wilmington, 1862, 'Death all around us'" *Tributaries*, (2005), forthcoming.

Halifax, Nova Scotia as a base of operation. From August until December 1864, ten blockade runners steamed from Halifax to Wilmington. This route was deemed somewhat impractical because of the long distance and increased chance of capture by the Union Navy concentrated along the Atlantic coast of the United States.²⁸

The presence of yellow fever in the waters off the Florida Keys and the Gulf Coast remained to the close of the war. In the summer of 1864, the supply steamer *Union* left the Keys but bypassed its original destinations of Hampton Roads and Port Royal and steamed toward New York because fever erupted on board the crowded ship. Commanding Officer Edward Conroy concluded that the fever ceased after "having had very strong northerly winds for the last three days." Conroy assured Welles that "Every precaution has been taken, the ship well fumigated, and will bear the most strict inspection in every part of her."²⁹

Following the war, the navy maintained its presence in the Caribbean. The USS *Jamestown* anchored in Panama Bay as a store and hospital ship. In December 1866, fever erupted on the anchored *Jamestown*. Surgeon Delavan Bloodgood arrived two months later as the fever raged out of control. Bloodgood's colleagues advised that "the ship should sail immediately for a cold climate, explaining that such a degree of local infection existed that there was no hope of disappearance of the endemic fever while material remained for it to work on." Eventually, the *Jamestown* left Panama for San Francisco to rid the sloop of the fever and ended its journey at Sitka, Alaska, as a guard and storeship.³⁰

After the Civil War, United States physicians hotly debated the issue of spontaneous generation of fever on board ships despite the advances by European scientists in support of the germ theory. Contrary to the spontaneous generation position, the germ theory claimed that a specific microorganism caused a specified disease. American physicians, with some notable exceptions, were slow to accept this view. They still adhered to the belief that an invisible ether could be created under certain conditions, and a ship's hold was an ideal setting for generating, breeding, and/or transporting this poison. Furthermore, these poisons, also called fomites (derived from the Latin word for tender) could be trapped in enclosed atmospheres and transferred in certain kinds of cargo, mail, and fabric. Unlike the groundbreaking work of French scientist Louis Pasteur on microbiology, the fomite position was never thoroughly tested by American public health specialists.³¹

Postwar quarantine practices for commercial ports mirrored the practices of the United States Navy. From June to September at Philadelphia's lazaretto ten miles below the city on the Delaware River, a physician and quarantine master examined incoming ships, crews, cargoes, and passengers. Despite these preventative measures in 1870, the fever

²⁸ Stephen R. Wise, *Lifeline of the Confederacy: Blockade Running During the Civil War* (Columbia, SC 1991), 191-192, 240-241.

²⁹ *ORN*, Vol. 27, 593.

³⁰ Bloodgood, "United States Ship *Jamestown*," 184-186.

³¹ Phyllis Allen Richmond, "American Attitudes Toward the Germ Theory of Disease (1860-1880)," *Journal of the History of Medicine and Allied Sciences*, 9 (October 1954), 428-433, and 453; and Raymond N. Doetsch, "Early American Experiments on 'Spontaneous Generation' by Jefferies Wyman (1814-1874)," *Journal of the History of Medicine and Allied Sciences*, 17 (July 1962), 325.

appeared along the city's waterfront after taking the lives of the lazaretto's physician, master, the master's wife, and eighteen nearby residents. The *Home* was implicated in this outbreak because of the vessel's filthy condition and last port of call; it was assumed that the vessel was infectious, not just a transporter of ill passengers. Despite this popular assumption, the renowned yellow fever expert René La Roche insisted that the *Home* had been properly cleaned, fumigated, and whitewashed, and was not anchored in location to be the epicentre of the fever. The vessel even remained in quarantine until the first frost. Consequently, according to La Roche, the source of the fever on this particular occasion had to be the favourable conditions found along the waterfront.³²

In 1879, Dr Alfred Stille summarized a slightly different view of the ship as a carrier of the fever in an address to the graduating medical class at the University of Pennsylvania. In his discussion of "the conditions that generate yellow fever," on board a ship with a fit crew, Stille concluded "the vessel's hatches are opened; stevedores belonging to the port unload its cargo. And presently they are all attacked with the fever, as well as the men on board the vessel lying alongside of the infected ship. It is evident that the ship itself, or something in it, but not the crew, was the cause of the outbreak, and equally evident that the morbid poison must be brought from the port whence the ship came."³³ Therefore, it was Stille's hedging assumption that ships could be efficient carriers of the fever, or the source of its generation. Supporters of Stille's view would target ports that had outbreaks of fever, and strictly quarantine vessels that traded goods from those infected harbours.

Stille's choice of the word "something" is telling as practitioners did not know the exact source of the fever. For the scientists that searched for the yellow fever "germ," the hunt for the pathogen continued well into the twentieth century. This, however, did not prevent scientists from making unsubstantiated claims concerning the isolation of the specific organism. In 1878, as the nation's worst yellow fever epidemic raged through the Mississippi Valley, Dr T.S. Bell of Louisville summarized the frustrating situation. He concluded "I know nothing on the history of disease more surprising than the little progress made in understanding the phenomena of any disease than that attending the history of yellow fever. The wonderful sameness of observations for nearly four hundred years is bewildering."³⁴

Late in 1879, one of the most perplexing outbreaks of fever unfolded on the screw sloop-of-war USS *Plymouth*. In spite of the commanding officer's protective measures, a few bluejackets contracted yellow fever at St. Croix. The surgeon transferred the sick to a local hospital, and the sloop steamed north towards Norfolk. En route, the fever reappeared and the vessel then headed for Portsmouth Navy Yard in New England with the expectation that the pestilence could be throttled by colder weather. In port, the sailors off loaded their gear and gave their ship a thorough cleaning in freezing weather, they sailed for Boston to conclude the cleansing process where a hundred pounds of sulfur were burned below decks.

³² Edward T. Morman, "Guarding Against Alien Impurities: The Philadelphia Lazaretto, 1854-1893," *Pennsylvania Magazine of History and Biography*, 108 (January 1984), 132-135

³³ Alfred Stille, "Yellow Fever," *Scientific American Supplement*, 7 (23 August 1879), 3022.

³⁴ *Ibid.*, 3023; Bell, "What is Yellow Fever?" 85.

On 15 March 1880, the sloop left Boston for the Windward Islands. Rough seas forced the closing of the hatches, which resulted in warm temperatures below decks. Two new cases of fever appeared and the *Plymouth* returned to Portsmouth.³⁵

This situation surrounding the sloop received its share of attention in the medical press. The vessel's surgeon, Theron Woolverton, announced "I am convinced that the fever is confined to the hull of the ship, and, the unsound wood about the berth deck." Likewise, a trio of naval medical inspectors concluded "In view of the fact that *Plymouth* has been continuously in commission for four years and a half, a greater portion of that time in tropical or sub-tropical climates, and that she has had two outbreaks of yellow fever within five months we think it injudicious that she should be kept longer in commission." The *Plymouth* was decommissioned for a second time and remained in ordinary until being scrapped five years later.³⁶

The circumstances surrounding the *Plymouth* help to perpetuate the belief among the United States medical community in self-perpetuating toxins. Two of the most vocal civilian proponents of the self-perpetuating toxins were doctors Robert Bell Smith Hargis and John Gamgee. Their books, respectively, *Yellow Fever: Its Ship Origin* (Philadelphia, 1880) and *Yellow Fever A Nautical Disease: Its Origin and Prevention* (New York, 1879), outlined their positions for cause and cure. Hargis's position may have been shaped by his tenure as a port physician and marine hospital surgeon at Pensacola. He claimed that on "ocean-infected Ships... Only those who have smelt, the combined sulphuretted hydrogen and fetid ammoniacal odors,... can appreciate the character of this poisonous gas, incapable of supporting combustion and animal life." In his concluding chapter, Gamgee, a British veterinarian, opened with this simple premise, "Yellow fever exists permanently in some of the ships sailing the West Indian seas, extending eastward in the Atlantic... This is its permanent home."³⁷

Interestingly, novelist Jules Verne debated yellow fever's origins in his oceanic masterpiece *20,000 Leagues under the Sea* (Paris, 1870) and advanced a theory based on a French scientist's opinion that touched upon the conclusions of Gamgee and Hargis of a marine origin for the fever. As the submarine *Nautilus* neared Surinam (French Guiana), Professor Pierre Aronnax led a discussion about the impact of over hunting on the populations of seals, manatees, other mammals that fed on sea grasses in ocean and tropical rivers. As a result, the growth in the underwater grass exploded, and the rotting vegetation was "fouling the air, and that poisoned air causes the yellow fever that devastates these

³⁵ A. M. Moore, "Yellow Fever on the United States Steamship Portsmouth," *Medical Record*, 26 (5 July 1884), 7; "Yellow Fever on the Plymouth," *Boston Medical and Surgical Center*, 100 (March 27, 1879), 550; and "Effect of Freezing on Yellow-Fever Infection- The Case of the USS Plymouth," *Sanitarian*, 7 (August 1879), 348-349.

³⁶ "Effect of Freezing on Yellow-Fever Infection- The Case of the USS Plymouth," 353; "Frost and Yellow Fever," *Scientific American*, New Series, 40 (26 April 1872), 256.

³⁷ Robert B.S. Hargis, *Yellow Fever: Its Ship Origin* (Philadelphia, 1880): 4-8, 30-31, 45; Howard A Kelly and Walter L. Burrage, eds., *Dictionary of American Medical Biography* (British Virgin Islands, 1979), 527; John Gamgee, *Yellow Fever: A Nautical Disease, Its Origin and Prevention* (New York, 1879), 195; and Bess Furman, *A Profile of the United States Public Health Service, 1798-1948* (Washington, DC, 1949?), 160.

remarkable countries. That toxic vegetation has increased beneath these warm seas of the Torrid Zone, so that the disease spreads unchecked from the mouth of the Rio de la Plata to Florida!"³⁸

With the mystery of yellow fever unsolved, the disease continued to haunt mariners. In 1888, yellow fever attacked fifteen hands of the USS *Boston* while in the Caribbean. The *Boston* turned north and began the usual cleaning procedures. Somewhat differently than the *Plymouth* dilemma, a medical team did not point to the interior of the ship as the source of the fever. Instead, exterior causes were blamed. Also, rather than chilling the fever, these inspectors recommended steam heating, compartment by compartment. This idea was never executed because naval engineers predicted the process would have destroyed the timber in the interior, and with the metal hull in cold water, the heat would have caused an uneven expansion of the plates that could sink the ship. As for the general public, the *Marine Journal* reported that the situation concerning the *Boston* "let loose a flood of articles and views on the possibilities of the germs of fever remaining dormant and liable to break out again in certain atmospheric conditions."³⁹

Regardless of the positions held by naval surgeons, Verne, Gamgee, and Hargis, by the early 1880s, American medical circles accepted the possibility that yellow fever was caused by a specific pathogen. Early efforts to locate the microorganism proved unsuccessful. Nevertheless, the assumption that filth was a catalyst for the fever and that an unkempt ship was the ideal receptacle to transport and foster the growth of the organism remained a strong theme in the literature. Therefore, the efforts to eliminate the development of the fever in foul ships remained constant even if the fever organism had to be introduced into the ship.

The late nineteenth-century fear of the fever was not restricted to Atlantic Ocean shipping. This panicky trend surfaced in San Francisco when the bay's quarantine officer mistook three ill, steamship passengers for yellow fever victims. The SS *San Bias* had arrived from Panama via Mexico. The officer quarantined the ship at chilly, wind-swept Mission Bay instead of the usual anchorage at Saucelito, a milder location. The sick passengers died. Dr J.T. Shipley, a fellow passenger, was outraged at the mistaken diagnosis by the quarantine official, and the treatment of the victims. Shipley reported his findings to the *Pacific Medical and Surgical Journal*. Following the doctor's biting article, the journal's editors remarked "We cannot avoid the conclusion that our community has suffered much needless alarm on account of the Mexican epidemic, even admitting that it was Yellow Fever of the genuine type. The dread of contagion and the measures adopted to protect against it, always carry with them an element of inhumanity and barbarism from which not only the sick suffer but their families and companions who are free from disease."⁴⁰

³⁸ Jules Verne, *20,000 Leagues under the Sea*, trans. and annotated by Walter J. Miller and Frederick P. Walter (1870: reprint Annapolis, MD, 1993), 340.

³⁹ "The Yellow Fever on the Boston," *Marine Journal*, 11 (8 December 1888), 9; "The Yellow Fever Infection and the Proposed Method of Disinfection of the U.S.S. 'Boston,'" *Sanitarian*, 22 (January 1889), 36-46.

⁴⁰ J.T. Shipley, "Yellow Fever on the Steamship - 'San Bias,'" *Pacific Medical and Surgical Journal*, 26 (January 1884), 296-298.

Shipley's outrage was understandable, but so were the actions taken by the nameless quarantine officer and the grim conclusions drawn by the journal editors. Yellow fever devastated trade by creating absolute panic and by killing seamen and the inhabitants of ports. City fathers quickly established quarantines against infected ports, cutting off the flow of goods, travellers, immigrants, ships, and information. Therefore, the San Francisco quarantine officer's decision to isolate the sickened passengers and infected ship in cooler waters to eliminate the pestilence was consistent with this assumption.⁴¹

Along with cleansing, heating, and chilling, alterations in vessel construction were thought to be another means to prevent fever generation. The editors of the *U.S. Nautical Magazine* clamoured the "cause of fever on shipboard, whether it be known as *ship* or *yellow*, or any other color, lies deep on the elements of construction, and would never have known if proper attention had been paid to the construction of the vessels." This same powerful message echoed in *The Nautical Magazine's* article titled "Foul Air in a Steamboat's Hold." Recommendations included a clear grasp of the hull construction that did not depend on the massing of great timbers along the keel but a true understanding of the points of stress and the use of iron supports to allow the better airflow. Maccoun, the surgeon of the *Susquehanna*, conceded that the frigate was "at all times in excellent order" but "under the present mode of construction and arrangement of the hold, cannot be got at unless she is thoroughly *broken out*, and the floor taken up, so as to expose the bilge and limbers."⁴²

Proper ventilation and cleanliness became a mania for surgeons from the holds to the hatches, assuming that "under the hatches of a vessel, septic vapours are copiously engendered and most highly concentrated." Navy Medical Inspector Albert L. Gihon reported that commanders paid little attention to ventilation beyond the rigging wind-sails to ventilate the lower decks in fair weather. Gihon advocated using attended fires to increase air circulation, ventilating funnels with movable cowls, and affixing slimmer iron gratings over hatchways as opposed to more obstructive wooden hatches, and the regular aeration of foodstuffs.⁴³

Many surgeons presumed not only should the ship be clean and dry but also the ballast should be smooth stones free of debris and dirt. This explains why Kollock noted the organic salad found mixed with iron and clay ballast on board the *General Greene*. In that same vein, La Roche deferred to the assessment of British naval surgeon Sir Gilbert Blane's observation that ballast of sand, gravel, and organic material generated the foul vapours and fever. This problem also applied to the holds of steamboats where mud and water mixed with

⁴¹ *Ibid.*

⁴² "Ship Ventilation," *U.S. Nautical Magazine and Naval Journal*, 5 (November 1856), 96; Albert Leary Gihon, "Practical Suggestions in Naval Hygiene," in *Medical Essays*, 48-57; "Foul Air in a Steamboat's Hold," *Nautical Magazine Monthly and Quarterly Commercial Review*, 1 (November 1854), 90-92; and Maccoun, "Account of Yellow Fever, as it occurred on board the U.S. Frigate 'Susquehanna,'" 326, 327.

⁴³ Daniel Osgood, *Cautions to Seamen and Other Voyagers for Shunning The Yellow-Fever* (Boston, 1821), 7; Albert Leary Gihon, "Practical Suggestions in Naval Hygiene," in *Medical Essays*, 47-57; Stoner, *Handbook for the Ship's Medicine Chest*, 70-72; and [Mitchill] "Illustrations of the Spoiling of Beef," 243.

lubricants of tallow and oil.⁴⁴

Along Fernandina Beach, Florida, underwater archaeologists have found a dumping ground for ballast near a former, late nineteenth century quarantine station. The archaeologists concluded that the ballast was jettisoned during the summer months as a method for protecting seaside communities against the fever. Similarly, rather than dump the ballast when the fever threatened, some quarantine stations required the dipping ballast rocks in a solution of bichloride of mercury.⁴⁵

In the wake of the national epidemic of 1878, a proposal surfaced for the development of a means of freezing entire ships in warm-water ports. Gamgee was the leading advocate of this technique. The freezing proposal called for a massive refrigeration ship that could engulf and chill another ship thus killing the fever poison.⁴⁶ Gamgee's proposal even received Congressional attention. On 18 April 1879, the Senate appropriated \$200,000 for a refrigeration ship to be home ported in New Orleans. Twenty-four firms competed for the contract. The editors of the *Boston Surgical and Medical Journal* remarked "that the project is an experiment worthy of trial." Dr John S. Billings of the newly-formed National Board of Health spearheaded the construction drive. Surgeon-General John B. Hamilton, of the long-established Marine Hospital Service, however, opposed the plan, as the two agencies jockeyed for funding and public health responsibilities.⁴⁷

Outside the National Board of Health, the icy plan had plenty of critics. The initial response in *Scientific America* supported the scheme considering the potential savings to shipping. Subsequent articles, however, claimed that there was "no positive proof of a yellow fever infection and that the freezing method had failed on the *Plymouth*. The program would require more than twenty ships at various ports and soon would become cost prohibitive. Detractors also pointed out the difficulty in chilling the hold of a ship and freezing a hull submerged in room-temperature water. "It may, then, be asserted that it is practically impossible to so thoroughly absorb the heat from these interstices as to make the destruction of the spores a matter of certainty." Amid the debate, the Senate published the findings and opinions of experts. This report tended to reflect the opposition's view. With constant resistance to the refrigeration flotilla undermining the project, the fleet was never

⁴⁴ Ralph Chester Williams, *The United States Public Health System, 1798-1950* (Washington, DC, 1960), 81; Danforth P. Wright, *Seaman's Medical Guide, Containing the Symptoms, Causes, and Treatment of Diseases* (Boston, 1834), 8; "Death in the Ballast," *Nautical Gazette*, 7 (16 September 1874), 187 quoting from *The Lancet*; Kollock, "Malignant Disease," 2-3; Maccoun, "Account of Yellow Fever, as it occurred on board the U.S. Frigate 'Susquehanna,'" 326; and La Roche, "Facts and Observations on the Origins of Yellow Fever from Local Sources of Infection, as Illustrated by Occurrences on board Ships," 318-319.

⁴⁵ "Death in the Ballast," *Nautical Gazette*, 187; and William M. Jones, "The Source of Ballast at a Florida Site," *Historical Archaeology*, 10 (1976), 42-45.

⁴⁶ "Disinfection by Cold," *Scientific American*, New Series, 40 (22 February 1879), 117; Furman, *U.S. Public Health Service*, 161-167.

⁴⁷ Furman, *U.S. Public Health Service*, 164-167; Ellis, *Yellow Fever and Public Health in the New South*, 77-81; "Yellow Fever on the *Plymouth*," *Boston Medical and Surgical Journal*, 100 (27 March 1879), 550.

built.⁴⁸

A decade later, the navy took the cold weather quarantine concept to its most extreme, when the head of Medicine and Surgery established an isolated station in New England for sailors and warships "infected" with the yellow fever. The navy's annual report for 1885 noted a "temporary hospital or quarantine station to which naval vessels containing yellow-fever patients might be sent has been established on Widow's [Widow] Island off the coast of Maine." Congress agreed with the recommendation and granted permission for the placement of a more permanent complex at the same location in Penobscot Bay.⁴⁹

In 1888, the bureau head announced that the yellow fever hospital accommodated at least fifty patients and nearby exercise and transportation facilities had been improved. The residents of nearby islands were naturally reluctant to have such a potentially dangerous complex in their realm. The reaction of the Mainers was similar to that of the citizens near Portsmouth, New Hampshire when warships were isolated in the navy yard. Through the pacifying assurances of Passed Assistant Surgeon Arthur C. Heffenger, the natives of the Penobscot region grudgingly accepted the new quarantine station. Heffenger's energies, however, may have gone for naught. It appears that no ill sailors recuperated in the hospital or ships anchored in the bay's cold waters to reverse the effects the dreaded fever poison or germs. Heffenger's "special duty" assignment ended after a few years.⁵⁰

The navy's failure to make the utmost use of the grimly-named Widow Island facility may stem from a major change of thinking among sanitation, public health, and scientific professionals. A few opponents to chilling the fever advocated steam heat disaffection. More likely, by the mid-1880s, most members of these interrelated fields had finally accepted the germ theory as the cause of many diseases. Therefore, chemical disaffection became the preferred method of eradicating the fever along the lines advocated by British surgeon, Dr Joseph Lister.

Dr Joseph Holt of the Louisiana State Board of Health referred to the recently coined term "maritime sanitation" and noted that it signified "the application of modern methods suggested by sanitary science and approved by experience in the treatment of all carriers, persons and things traversing the seas." This adjustment reflected the thinking that a specific microorganism that caused the disease, and the belief in spontaneous generation of yellow

⁴⁸ Furman, *U.S. Public Health Service*, 164-167; "The Fallacy of Refrigerating Ships for the Destruction of Yellow Fever Germs," *Scientific American*, New Series, 41 (30 August 1879), 129; A. N. Bell, "Origin of Yellow Fever," *Scientific American Supplement*, No. 159 (18 January 1879), 2528; and "Frost and Yellow Fever," *Scientific American*, New Series, 40 (26 April 1879), 256.

⁴⁹ *Annual Report of the Secretary of the Navy for the Year* (Washington, D.C., 1884): I, 33; *Annual Report of the Secretary of the Navy for the Year 1885* (Washington, DC, 1885): I, 33; *Annual Report of the Secretary of the Navy for the Year 1886* (Washington, DC, 1886): 25; *Annual Report of the Secretary of the Navy for the Year 1887* (Washington, DC, 1887): 43; *Annual Report of the Secretary of the Navy for the Year 1888* (Washington, D.C., 1888), 40.

⁵⁰ *Ibid.*; Charles B. McClane, *Islands of the Mid-Coast of Maine: Blue Hill and Penobscot Bays* (Woolwich, ME 1982), 137-138; Paolo E. Coletta, ed. *United States Navy and Marine Corps Bases, Domestic* (Westport, CT and London, 1985), 658; and *Registers of the Commissioned and Warrant Officers of the Navy of the United States, and of the Marine Corps* (Washington, DC, 1887-1889), Heffenger is listed on page 40 in all three volumes.

fever fomites, vague poisons, and miasmatic gases faded.⁵¹

Southeast of Louisiana in the spring of 1898, the federal government dispatched tens of thousands of American armed service members to Cuba during the Spanish American War. During the brief conflict, far more Americans fell to malaria and yellow fever. Back home, Americans braced for the possibility that returning personnel would bring the fever into the country. Therefore, public health authorities monitored humanitarian relief vessels and United States warships as tightly as any jaundiced-looking soldier. Clara Barton of the American Red Cross recalled the remaining cargo of the relief ship *Clinton* was offloaded at the quarantine station at Egmont Key, Florida and crew, ship, and cargo had to spend five days in isolation before proceeding north. Ironically, Barton remembered that stay would have been pleasant except for the "gnats, mosquitoes, sand fleas, snakes and daily storms."

Maritime cleanliness remained a yellow fever issue until the twentieth century. In 1900, Surgeon General George W. Stoner advised ship masters "yellow fever thrives on filth" and "personal cleanliness and a clean, dry, well-ventilated ship are the best means of protection against the ravages of the disease." Shortly after the Spanish-American War, the preliminary findings US Army Major Walter Reed's Yellow Fever Commission's research in Cuba showed that the *A. aegypti* mosquito was the yellow fever vector.⁵²

In 1901, Drs Henry Rose Carter and Joseph Goldberger, investigators for the US Public Health and Marine Hospital Service, applied Reed's conclusions to a maritime setting. Ships were still seen as incubators for yellow fever but now observations showed that ships carried adult mosquitoes and larvae. Carter concluded that vessels were infested with the infectious and ill individuals actually contracted the fever while shipboard. Simultaneously, Goldberger studied prevailing harbor winds in Havana to determine how infectious mosquitoes might drift onto anchored ships.⁵³

With two decades of hindsight, noted surgeon and yellow fever fighter, Rudolph Matas, concluded that of "all the influences that retarded the development of the modern concepts of the infectious and epidemic diseases, the belief in the spontaneous generation of these epidemics out of 'miasms' emanating from decomposing inorganic or dead organic matter... was the greatest hindrance." Certainly, the circumstances surrounding cases such as the *Plymouth* pointed to an agent that was able to remain dormant and infect sailors

⁵¹ Joseph Holt, *An Epitomized Review of the Principals and Practice of Maritime Sanitation* (New Orleans, 1892), 7.

⁵² Humphreys, *Yellow Fever and the South*, 30-31; Clara Barton, *The Red Cross: In Peace and War* (Washington, DC, 1899), 652; George W. Stoner, *Handbook for the Ship's Medicine Chest* (Washington, DC, 1900), 72, 70; William B. Bean, *Walter Reed: A Biography* (Charlottesville, VA, 1982), 141-154; and John M. Gibson, *Physician To The World: The Life of General William C. Gorgas* (Durham, NC, 1950), 57, 72, and 169-171. It should be noted that at the time of the Yellow Fever Commission's work the fever mosquito was known as *Stegomyia fasciata*.

⁵³ Henry Rose Carter, "Are Vessels Infected with Yellow Fever?: Some Personal Observations," *Yellow Fever Institute Bulletin No. 9* (Washington, DC, 1902), 7, 9; S.B. Grubbs, "A Note on Mosquitoes in Baggage," *Yellow Fever Institute Bulletin No. 6* (Washington, DC, 1903), passim; Henry R. Carter to Joseph Goldberger, 28 September 1903, and Henry R. Carter to Joseph Goldberger, 15 October 1903, Joseph Goldberger Papers (#1641), L.R. Wilson Library, Southern Historical Collection, University of North Carolina at Chapel Hill.

without the presence of a mosquito and contributed to the continued belief in spontaneous generation.⁵⁴

Still, the many contentious issues surrounding yellow fever resulted in the understandably slow acceptance of Reed's findings. Furthermore, Reed's colleagues never identified the pathogen that caused the yellow fever despite their efforts to isolate the virus. This reluctance to accept Reed's findings had tragic consequences. Yellow fever continued to outbreak in the United States until 1905, when, during an epidemic in New Orleans, a well-orchestrated effort eliminated the mosquito-breeding potential of open receptacles and curbed the attack. This eradication campaign spearheaded by the US Public Health and Hospital Service marked the last epidemic in America and finally convinced detractors of the validity of the "mosquito theory."⁵⁵

⁵⁴ Walter Reed et al., "The Etiology of Yellow Fever: A Preliminary Note," *Philadelphia Medical Journal*, 6 (27 October 1900), 790-796; Rudolph Matas, "A Yellow Fever Retrospect and Prospect," *Louisiana Historical Quarterly*, 8 (July 1925), 455; and Bean, *Walter Reed*, 158-170.

⁵⁵ Humphreys, *Yellow Fever and the South*, 40.