Surgery at Sea:

An Analysis of Shipboard Medical Practitioners and Their Instrumentation

By

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Abstract:

Shipboard life has long been of interest to maritime history and archaeology researchers. Historical research into maritime medical practices, however, rarely uses archaeological data to support its claims. The primary objective of this thesis is to incorporate data sets from the medical assemblages of two shipwreck sites and one museum along with historical data into a comparative analysis. Using the methods of material culture theory and pattern recognition, this thesis will explore changes in western maritime medical practices as compared to land-based practices over time.

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FIGURE I. Cautery of a wound or ulcer. (Gersdorff 1517.)

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By

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An Analysis of Shipboard Medical Practitioners and Their Instrumentation

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Ich bin berufen allenthalben
Kann machen viel heilsame Salben
Frische Wunden zu heilen mig Gnaden
Dergleichen Beinbruch und alte Schaden
Franzosen heilen den Star stechen
Den Brand löschen und Zähn ausberechen
Dergleichen Balbieren, Waschen, und Schären
Auch Aderlassen tu ich gern
-Hans Sachs (16th century)

I am called everywhere
I can make many healing salves
I can cure new wounds,
Fractures and chronic affections,
Syphilis, Cataract,
Gangrene, pull teeth
Shave, wash and cut hair,
I also like to bleed
-Hans Sachs (16th century)

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Chapter 1: Introduction

Through the years, maritime related theses have focused on many aspects of shipboard life. Researchers have studied diverse topics such as Laurel Seaborn's master's thesis on the role of women onboard and Leland Geletka's thesis research on the use of sea-shanties on vessels. Such studies help researchers better understand the complex and intricate nature of shipboard life either in specific or general terms. Comparative analyses of historic documents and/or archaeological sites provide researchers with vital information, and such an analysis is the basis of this thesis.

One of the most important aspects of shipboard life is the health and welfare of the crew. The practice of medicine has evolved throughout recorded history as humans have searched for ways to ease pain, conquer sickness, and extend life using available knowledge and tools. So too has the role of the ship's medical practitioner evolved, as they strived to provide the best possible care for all of the crew and passengers on board. Prior to the advent of a dedicated ship's medical practitioner, skilled crew members such as carpenters, cooks, or even gunners did their best to prevent or treat whatever diseases or mishaps befell those onboard. Whatever their background, from earliest times the ship's medical practitioner was prepared with their medical training and/or recipe book, their chest, and its contents.

This thesis will examine medical instrumentation from shipwrecks *Mary Rose* (1545) and *Queen Anne's Revenge* (1718) in an effort to better understand Western maritime medical practices and to ascertain if ships' surgeons were intentionally bringing instruments specific to their voyages, or simply what they were able to fit into their chests. The medical assemblages recovered from both wrecks will be compared to a land based selected collection from The

Mütter Museum to determine any differences. The assemblages represent both a difference in collecting patterns (single versus multiple sources) as well as spanning pre- and post-medical enlightenment. Both of the shipwrecks occurred prior to the age of medical enlightenment (around C.E. 1750), during a period of little incremental change in medical technology. The period after medical enlightenment represents a rapid change in medical beliefs (i.e.: four humors to circulatory system) and training; individual medical instruments reflect these changes in typology and quantity of objects. Thus, these assemblages allow for comparison over an extended period of time.

To understand the role and impact of the ship's medical practitioner, the first step is to understand the history of medical practices at sea and medical instrumentation. Without this knowledge, it is not possible to compare maritime medical practices to those on land.

Other necessary information includes the history of medical training in different countries or regions. Though most training centers followed a basic teaching method, medical practitioners from different countries followed different courses of study relevant to the diseases and climate(s) in which they might work. For instance, although the Danish did not teach a course regarding tropical diseases that medical practitioners on Danish slave ships would encounter, the medical students had access to 2-3 books on the subject (Bierlich 2009:238). Thus, a Danish medical practitioner fresh from training would have been little better prepared than a contemporary German counterpart to treat maladies indigenous to the tropics such as malaria and yellow fever (Bierlich 2009:236-241). On the other hand, some regionally developed knowledge was not widely appreciated or adopted. For example, English medical practitioner John Woodall included a section in his book *The Surgions Mate* (1617) that described how a diet consisting of fresh fruit and vegetables could to stave off scurvy onboard ships, well before Dr. James Lind's

famous at-sea experiments in 1747 (Woodall 1617:184-185; Friedenberg 2002:57-59). This information, though widely available to English medical practitioners, would not be added as a standard treatment for scurvy on vessels until it was adopted by the British Admiralty in 1795 (Bollet 2004:176). These examples illustrate the possibilities that differences in both regional and individual medical training and practice may account for variability in historic documents and archaeological assemblages.

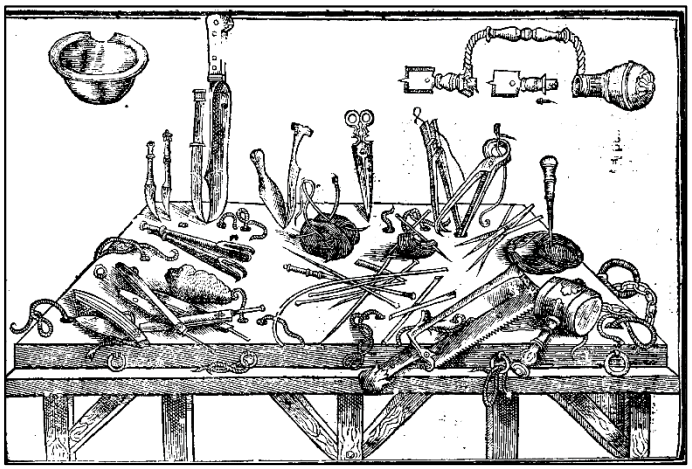

FIGURE 1. Medical Practitioner's Instruments (Clowes 1637:140).

Medical instruments (Figure 2) found onboard a vessel reflected the standard (contemporary) treatments, practitioner's personal knowledge, requirements of the company or country the ship sailed under, and the broad spectrum of ailments treated by the medical practitioner. Typical instruments found onboard vessels included knives/scalpels, shears/scissors, needles, a measuring system, ceramic or wood containers to hold medicaments, syringes, forceps, bullet extractors, bleeding bowls for bloodletting, and (bone) saws (Clowes 1637:110; Woodall 1617:xvi-xvii). Other associated ephemera include mortar and pestle, hammers, pliers, glass vessels for cupping, and trepan or carpenter's drill. The practitioner carried these objects inside of a case or chest. Extant examples of such specialized cases from the late 18th century

that include multiple drawers, and inserts to keep containers and instruments in place during travel.

Several contemporary works explore the stories of the ships *Mary Rose* (1545) and the ship believed to be *Queen Anne's Revenge* (1718; hereafter referred to as *QAR*). Archaeologists and conservators that worked on these ships have published a great deal of literature pertaining to each ship's purpose, wrecking event, and recovery. These works include: Peter Marsden's *Archaeology of Mary Rose Vols. 1-4*; Julie Gardiner's *Before the Mast: Life and Death Aboard the Mary Rose;* Laura Kate Schnitzer's *Aprons of Lead*; Mark Wilde-Ramsing's *Steady as she goes…* and "Beyond Reasonable Doubt" written with Charles Ewen; "Mariners' Maladies" by Linda Carnes-McNaughton; and "Ruling Theories Linger" by Bradley Rodgers, Nathan Richards, and Wayne Lusardi.

Some controversy still surrounds the archaeological site designated 31CR314 regarding the site's identification as that of *QAR*. The governments of the State of North Carolina and United States of America have been satisfied enough to list it on the National Register of Historic Places and protect this archaeological site under the name *QAR* (National Parks Service 2013). The academic community largely accepts and investigates this site as such (Wilde-Ramsing and Ewen 2012), while others who demand further investigation prior to allowing the ruling theory to stand (Rodgers et al 2005; Ewen and Skowronek 2016). However, it is not the intention of this thesis to become embroiled in any controversy; instead, the artifact assemblage recovered from the wreck site is examined and available historic and archaeological data are used to answer questions regarding the onboard medical practitioner(s).

Of the two archaeological sites, the medical assemblage from *QAR* has the least compiled and published information. Researcher Dr. Linda Carnes-McNaughton has both published and

given a lecture regarding the findings to date on the medical assemblage of *QAR* (Carnes-McNaughton 2016). Her work, along with the raw data, provided a springboard for this thesis and the analysis contained here will help to close the gap and create a larger base of knowledge for further researchers of *QAR*. Therefore, the analysis of the medical assemblage of *QAR* is central to this thesis.

Material Culture Theory

Assemblage analyses of material culture are an important part of interpreting and understanding the relationship between historical documentation and the physical objects from an archaeological or museum source. There is a wealth of archaeological sites found around the globe and artifacts/objects from sites that have yet to be studied completely fill institutions. The site plan and artifact provenience is one dataset that archaeologists can use to learn useful information regarding past life-ways of the peoples studied. In order to understand a site's relevance and cultural nuances in greater depth, researchers should also consider comparative collections of material culture held in institutions as sources of data that can help to answer – and ask – more questions about a site. If the field of archaeology is to move forward responsibly, there must be a greater focus on assemblage analyses.

Archaeologists may use an assemblage analysis as a means of comparing different cultures, eras, or even historical documentation to the archaeological record. From such an analysis, the archaeologist can garner new insight into past life-ways and add to the body of knowledge. It is not always possible to empirically prove one's theories through research, however, comparative analyses may help answer or posit new questions that further the understanding of the human condition throughout time.

As this thesis deals directly and primarily with material culture, the assemblages were examined and analyzed using material culture theory, rather than one of the more traditional archaeological theories. Though these traditional archaeological theories such as Marxism, semiotics, or structuralism (referred hereafter as founding theories) are helpful in analyzing archaeological sites, they do not fully address how to assess material culture in a scientific manner, nor provide an innate physical methodology. Though they can be useful when studying material culture, the founding theories relate more directly to general knowledge, such as the overall analysis of an archaeological site or approach to specific cultures (Prown 1982:1-7; Tilley et al 2006:1-5).

To fully interpret cultural heritage objects, students and researchers must in some way imagine how the material culture would impact them were they living in a particular culture and/or time. This theory and its accompanying approaches allow researchers to fully interact with and study the objects on many different levels, allowing for successful cross-cultural and other comparative analyses. Therefore, material culture theory permeates every aspect of archaeological theory when dealing with any cultural heritage objects. Since material culture theory is the culmination of these founding theories and is specifically aimed at the research and assessment of cultural heritage objects and their context, it was the most relevant for this thesis (Prown 1982:5; Hodder 2012:171, 174-179).

One can approach the methodology corresponding to material culture theory in several ways. Originally described in a rigid manner by Jules David Prown (1982), this methodology has developed a less rigid approach in recent years, especially through the work of prominent archaeological theorists such as Ian Hodder (2012). Prown advocated for full sensory experiences with the objects to garner the most information. By interacting with the objects, he

believed that researchers could have a fuller understanding of the objects (Prown 1982:7-10). Hodder incorporated Prown's ideas along with the pattern recognition proposed by Stanley South (1978a, 1978b, 1979) and to advocate for the interpretation of material culture through drawing comparisons. This adaptation allowed researchers to develop theories through the interpretation of material culture as a dataset (Hodder 2012:175-179, 181-183).

Prown's (1982) full sensory methodological approach is not always possible, especially when working on a comparative analysis of assemblages spread throughout the globe. Therefore, the methodology for this thesis interprets the material culture as an historical dataset as described in Hodder's (2012) interpretation, and relies on the use of information from other researchers from the corresponding collecting institutions who have had firsthand experience with the objects. These researchers include Wendy Welsh, Shanna Daniels, Courtney Page, Sarah Watkins-Kenney, and Linda Carnes McNaughton from the QAR Laboratory; George Grigonis and Anna Dhody from The Mütter Museum; Jo Castle, Brendan Derham, Robin Wood, Jon Hather, and Jeremy Montagu from the Mary Rose Trust. The historical research along with their notes creates an easily compared and analyzed dataset.

Using the available information on *Mary Rose* (1545), *QAR* (1718), and The Mütter Museum, the analysis will be conducted through a comparison of both the historic and archaeological/conservation/museum primary sources; well researched and widely published secondary sources; agency gray literature; and first-hand experience with objects (as available). Although working from notes on the objects created by other researchers pertaining to the assessment of the objects is not ideal, it allows for the most thorough analysis within the time and budgetary constraints of this thesis.

Using this methodology, the individual medical instruments will be analyzed for both single and multi-function use in medical practice and, where possible, the quantity contained within the assemblage will be analyzed for statistical significance. Instruments such as needles, scissors, and knives are examples of instruments that have overlapping functions; these will be considered multi-purpose and analyzed within their medical usage. Size (or size extrapolation), material composition, and chemical residues (where available) will be used to determine possible onboard function(s). Other useful information regarding possible instrument function of the archaeological assemblages may be derived from intra-site location of where an instrument was discovered. This analytical data along with historical records will help determine instrument

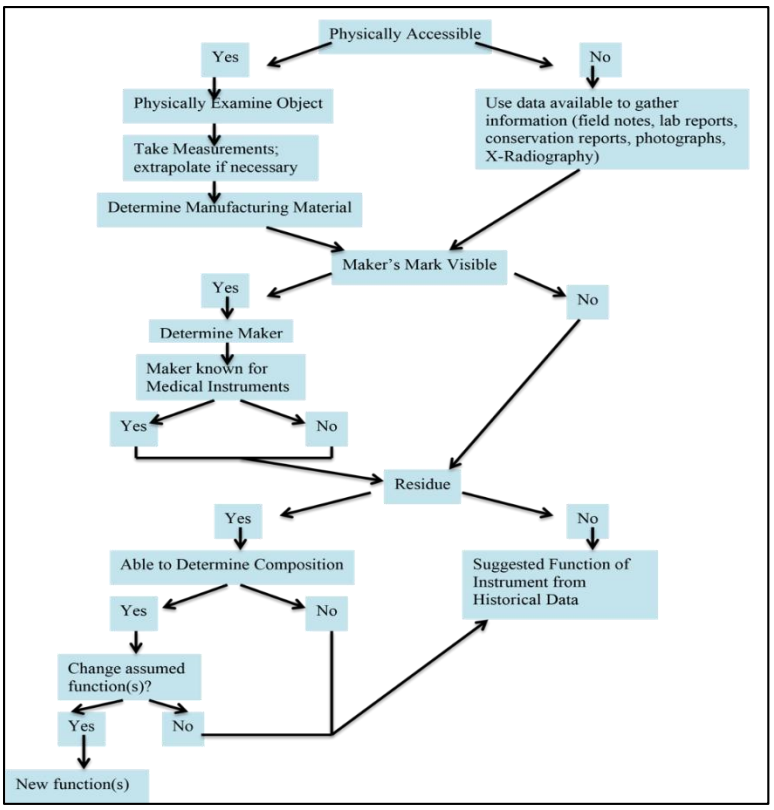

FIGURE 2. Analysis Flowchart. (Chart by author, 2015.)

usage, onboard medical needs, and possibly the general health of the crew of each ship.

For example, a pair of scissors in a medical assemblage of would be analyzed in several ways (Figure 3). First, the size of the handle and blades would be considered and determined for function; however, scissors of nearly any size could be multi-functional. Next, the material makeup of the scissors (such as silver or a ferric alloy), wear patterns, and any chemical residue will further help determine function; if the scissors contain any natural fibers such as linen, this may indicate general use, such as cutting sailcloth in addition to medical usage.

Finally, historical, archaeological, and conservation data collected about the individual item will be considered to help infer a specific instrument's function onboard. Information such as the objects' found location on the site map and relationship to other objects may further indicate its shipboard function. Single or specific functionality of a given object, though perhaps ideal, may not be easy to determine as many medical instruments, cooking implements, and carpentry tools have similar shapes and may have served multiple uses onboard a ship. Once the analysis of functionality is complete, the author will attempt to determine the role the instrument played in the care of those onboard the ship.

Research Questions

Through artifact analysis, this thesis will attempt to expand the current knowledge of the quality and health of shipboard communities. This thesis seeks to answer two primary questions and two secondary questions:

Primary Questions:

- Do the surgeons' kits reflect the contemporary knowledge and/or specific requirements of shipboard medical practices? Or are they merely a reflection of land-based practices?

- What can the medical assemblages tell us about the treatment of medical ailments and health practices onboard ships?

Secondary Questions:

- Does the assemblage of *QAR*'s archaeological site specifically reflect the skills and practices of the historic documentation?
- How do the shipwreck assemblages compare to the land-based assemblage?

These research questions require both an introspective and outward examination of the available sources of information, including the physical objects. The questions may prove to be too large to answer in this thesis, but its intent, regardless of meeting that objective, is to advance material culture analyses and the overall knowledge of health onboard ships.

Limitations

This thesis does have some limitations, including budgetary and time constraints, as well as access to assemblages that were appropriate for the original time period of chosen study (1540s-1720s). Using easily accessible assemblages led to a large temporal gap between the two studied shipwreck assemblages. Global medical museums were inaccessible online; therefore, the assemblage from The Mütter Museum, located in Philadelphia, was chosen due to the ease of accessibility. Again, the large temporal lag between the two archaeological assemblages and this museum assemblage created a gap in the data.

Other limitations included the differences in single-source versus multi-source assemblages, individual and museum collecting patterns, environmental controls (or lack

thereof), and cataloging practices. This study, therefore, should be considered keeping these limitations in mind.

Chapter Outline

The next chapters deal in depth with subjects discussed in this introduction. First is a discussion of maritime medical history and the history of medical instruments. The next two chapters deal with relevant theories and methodology for the assemblage analyses. The fifth chapter outlines the assemblage case studies from *Mary Rose*, *QAR*, and The Mütter Museum. The final chapter provides the individual and comparative analyses and conclusions. Included in the appendices section are site plans, photographs, and a table of the medical assemblages from each of the relevant case studies in table format for further research, perhaps providing insight for the next researcher.

Chapter 2: History

To understand the role and impact of the ship's surgeon, the first step is to understand the history of maritime medical practices and types of surgical instrumentation used at sea. Though the actual practice of medicine has changed considerably from the first recorded instances, humans throughout history have searched for ways to ease pain, conquer sickness, and extend life using available knowledge and means.

As medical practices moved onboard ships, practitioners took with them knowledge gained through instruction, study, and practicum. The practitioner's instrumentation and medicaments were either provided by the agency for which they worked (government or company) or were a part of their own personal kit. Historic documents reflect the contemporary treatments, medicaments, and instrumentation as well as the duties assigned to the shipboard medical practitioner.

Maritime Medical History

The history of medicine is a well-researched topic. The earliest records of surgery include paintings on the walls of Egyptian pyramids depicting the embalming process and the resetting of bones, and Herodotus' description of Egyptian circumcisions in 460 B.C.E. (Graham 1956:28). Zachary Friedenberg opens *Medicine Under Sail* with the Trojan Wars and a medical treatment described by Homer in book four of the *Iliad* as well as stating "Before the modern era, there was a long tradition of naval surgeons who were called upon to treat the injured and the sick … practitioners … were assigned to each trireme, one for each two hundred men" (2002:1). The exact date the medical practitioner's role became a fixed position on ships in Western history is unknown, though the role becomes increasingly visible after Christopher Columbus'

1492 voyage (Angela Thompson, pers. comm.). Instead, others filled the role of ship's doctor (such as the cook, gunner, or even the captain) who had the instruments, some knowledge of (human) anatomy, and/or could read the book of medicament recipes (Carnes-McNaughton 2016, elec. comm.).

The written surgical records embedded in the 18th century B.C.E. Code of Hammurabi included a "set of rules for the regulation of both surgical practices and the surgeon's fees" (Reidman 1962:16). These, along with the archaeological and ethnographic evidence for skull cuts, a procedure known as trepanning, used to release the 'demons' in the patient suffering from the 'falling sickness' (epilepsy or non-epileptic seizures), comprise the earliest records of surgery (Weston-Davies 1989:40; Fu 1999:127-128).

In western history, the early Christian Church recognized illness as a punishment from God for sins committed by the affected patient that only a miraculous event would cure them. Charity for the poor and ailing "served as means to receive God's forgiveness and ensure salvation" (Bagwell 2005:874). During the 4th and 5th centuries, patients received long-term care at charity hospices from women who were usually untrained. As time went on, the role of medical practitioner changed from layperson to the educated physicians. By the 10th century, universities – such as those at Salerno and Oxford – opened specifically to train physicians, though specialization in surgery was at the bottom of the curriculum (Bagwell 2005: 874; Graham 1956:88, 95).

The earliest forms of the 'modern' barber-surgeon came about in Europe during the Middle Ages, possibly due to the bubonic plague (Graham 1956:107-115). In 1308, English barbers in London established guild also referred to as a *Confraternity*; in 1354 it achieved the status of Company, and in 1368 the appointment of Master Surgeons, who exercised their

authority over the other members of the guild, gave the guild its official recognition. Other guilds sprang up across Europe after the establishment of the London guild, including Dublin, Edinburg, and Paris (Fu 2000:36). Barber-surgeons in the London guild obviously took great pride in their work as in 1375 they filed complaints with the Mayor and the Alderman of London regarding travelling, non-guild associated barbers; this demonstrates the skill and care with which these barber-surgeons operated:

> [B]arbers from Uppeland, little skilled in their craft, come into the City from day to day, take houses, and intermeddle with barbery, surgery, and to cure other maladies. Whereas they have not known nor ever were taught how to do such things to the great danger and cheating of the people, and grievous disgrace to all honest barbers in this city (British Medical Journal 1905:1606).

This company joined both the common practicing barbers with the university-educated surgeons until an act of Parliament dissolved the union in 1745 (British Medical Journal 1905:1605-1606; Fu 2000:37).

Books of the 16th and early 17th century such as Hans von Gersdorff's *Feldbuch der Wundartzney* (1517) and William Clowes' *A Profitable and Necessarie Booke of Observations* (1596) provide early evidence of medical practices for gunpowder and shot wounds. Gersdorff's book is considered to be the first to discuss advances in field medicine (mainly military) and include illustrations of specific procedures. Clowes dedicates approximately one third of his book to the treatment of syphilis and demonstrated the severity and frequency of the disease amongst those persons who would likely experience gunpowder or shot wounds, including

sailors. Though not specific to shipboard practices, this published information was available to onboard medical practitioners at the time.

Similarly, the publication of John Woodall's *The Surgions Mate* states that it is printed "chiefly for the benefit of young Sea-Surgions imployed by the East-India Companies" (1617: Title Page). The objects it lists, however, were most likely commonly used on ships prior to becoming standardized for merchant vessels such as those of the English East India Company (EEIC). Considered to be a key primary source for maritime medical historians (Angela Thompson, pers. comm.; Linda F. Carnes McNaughton, elec. comm.), this publication provides a full list of instruments and medicaments the practitioner should carry (or find) in their chest, for their use, and a description of the sea surgeon's specific duties (Woodall 1617).

Woodall goes into great detail regarding each instrument's usage as well as the uses of the medicaments and even refers to known historic practices. He begins the section on cauterizing irons with the statement:

> The auncient Chirgeons of former ages used these instruments farre more than those in our times; but the necessarie use of them in many cures is now forborne by reason of the terror thereof to the Patient is great, yet the use of them is very needful, as namely, to cauterize any veine or Arterire in strong fluexes of blood which cannot otherwise be staied (Woodall 1617:10).

Illustrations, though subjective, can also provide excellent primary information to the researcher. Susan Wheeler's *Five Hundred Years of Medicine in Art* (2001) provides an insightful view of the depiction of medical practices both on land and at sea through illustrations

dating from the 15th through the 19th century. Though not specific to shipboard life, the broad range of illustrations depict scenes including practitioners with their instruments, caring for patients, and performing surgeries such as limb amputation and tooth extractions; patients after care – such as amputees; and hospitals. The drawings also provide a foundational dataset of the types of instruments used in practice of this period. An example of this is the section on phlebotomy ranges temporally from the late 15th century to the early 19th century (Wheeler 2001:122-125). Illustrations from the period of the shipwreck assemblages (1540s-1720s) do not vary greatly to those of previous or successive centuries. The medical practitioners in those illustrations are depicted with common, contemporary instrumentation performing the treatments in the manner specified in many individual treatises. Therefore, the art provides a complementary visual representation and confirmation of the written record.

Even when ships began to include a dedicated medical practitioner, a role that became increasingly conspicuous after Columbus' 1492 voyage, the role of medical practitioner changed very little. They treated wounds, performed necessary surgeries, and treated the sick with their medical knowledge. Shipboard medicine was an area where old knowledge and the need for new techniques intersected. Not all physicians experimented but some, such as Dr. James Lind who is credited with assuaging the outbreaks of scurvy in the Royal English Navy from 1758 onwards, pushed the boundaries and advanced general medical science (Bown 2003: 95-98).

Maritime medical practitioners likely encountered ailments from three major categories: dietary diseases (including scurvy, beriberi, and vitamin D deficiency), tropical diseases (such as yellow fever and malaria), and wounds/injuries inflicted either from daily shipboard life or combat. Evidence regarding the presence and/or treatment of dietary and tropical diseases at sea lies primarily in the journals of the medical practitioners, residues of medicament containers, or

in logs concerning food and water provisioning (Mountaine 1761:66; Lavery 1998:481-483). However, the treatment of wounds or injuries can be inferred using a larger cross section of the medical assemblages from shipwrecks.

Stephen R. Bown addresses the history, causes, and historic and modern treatments of scurvy in his book, *Scurvy: How a Surgeon, a Mariner, and a Gentleman Solved the Greatest Medical Mystery of the Age of Sail* (2003). This work is a comprehensive overview of specific disease on ships during the "Age of Sail" (16th – 19th century), and Bown claims "Scurvy was responsible for more deaths at sea than storms, shipwreck, combat, and all other diseases combined" and that two million fatalities at sea due to this disease is a "conservative estimate … by historians" (Bown 2003:3).

Along with Dr. James Lind, Bown discusses the role of Captain James Cook in curbing the outbreaks of scurvy on long voyages. During his voyages to the South Pacific (1768-1771, 1772-1775, and 1776-1779), Captain Cook insisted that his crew have regular cold baths, clean hands, and plenty of fresh (antiscorbutic) foods whenever possible, and these practices resulted in a low number of fatalities during his 1769 voyage (Bown 2003:141-142). Bown concludes his book with a chapter on the role of scurvy during the Napoleonic Wars. He believes that part of the success of the Royal Navy is due to the regular onboard use of lime juice as an antiscorbutic during blockades (Bown 2003:185-209).

Other literature is more specific to pirate and slave ships, and therefore pertinent to this topic. In *The Pirates of Panama* (1684), Alexandre Esquemelin describes the process for determining the pay for each of the members of a pirate crew:

> First, therefore, they mention how much the captain is to have for his ship; next, the salary of the carpenter or shipwright, who careened, mended, and rigged the vessel: this commonly amounts to one hundred or one hundred and fifty pieces of eight … also a salary for the surgeon, and his chest of medicaments, which usually is rated at two hundred or two hundred and fifty pieces of eight (Esquemelin 1684:40).

Charged with providing the best possible care for all of the crew and passengers on board, this description provides evidence that surgeons were held in high enough regard to be rewarded handsomely for their work. Prior to onboard specialization, these practitioners treated whatever diseases or mishaps befell the crew. From scurvy to amputations, the ship's doctor was expected to be prepared with a medical chest and well-stocked assortment of contents.

Journal articles that cover Atlantic World voyages and medical issues are an especially useful source of information about shipboard medical practices and instruments. In both his article "The Guinea Surgeons on the Middle Passage" (1981) as well as his book, *Doctors and Slaves* (1985), Richard Sheridan provides insight into the treatment of slaves during the voyage from West Africa to the Caribbean, both pre- and post- age of medical enlightenment (1750s). Specifically, Sheridan offers some understanding on the recruitment of physicians for slaving vessels, the difficulties of practicing medicine on both the crew and human cargo during the voyage, and the callous view of some physicians who kept slaves alive simply for monetary purposes. Sheridan's article entitled "The Doctor and the Buccaneer" (1986) explores the world of physicians in the Caribbean – their interactions with vessels, pirates, and the difficulties faced with providing medical care in the New World.

Bernhard Bierlich also addresses medicine practiced on slave ships in the article "The Danish slave trade, its surgeons and slave mortality from 1674 to 1839" (2009). Though it deals specifically with the Danish slavers, there are some parallels to both British and French slaving vessels from this time period (Sheridan 1981, 1985, 1986; Bierlich 2009:231-232). Bierlich examines the professionalization of Danish medicine prior to and during the time period (1674-1839). Citing a small guide from 1807, he indicates that in all of the medical literature available to medical students and professionals at the *Kgi. Kirurgiske Akademi* (Royal Academy of Surgeons), only two to three literary sources dealt specifically with tropical medicine/tropical diseases as no courses were taught on tropical medicine (Bierlich 2009:238). He concludes, therefore, that the Danish medical practitioners were ill-prepared to deal with illnesses encountered on the Middle Passage and in the Caribbean and relied heavily on a combination of "training in non-tropical conditions, knowledge gained from readings of foreign texts on Tropical Medicine" along with practical experience gained from the military and mercantile voyages they undertook (Bierlich 2009:238-239).

Pratik Chakrabarti's *Materials and medicine* (2010) focuses on medical practice during the 18th century, the age of medical enlightenment and discovery in which medical practices expanded by acquiring new materials and methods such as the raw ingredients to create medicaments and medical instruments, as well as the establishment of hospitals in British colonies. The first chapter briefly mentions "buccaneer surgeons" and the role that piracy played in establishing medical protocols in the British West Indies. He claims that "buccaneers preferred to be in close touch" with the surgeons as they not only provided great care for any men injured during raids but also "were given special consideration in the sharing of the booty" (Chakrabarti 2010:23). Like Richard Sheridan's works, Chakrabarti also mentions the importance of medical

practitioners on board slavers and states that captains had to certify that the human cargo was free from disease prior to admittance to any port (2010:24). In the book's second chapter, entitled "War, settlement, and medicine in the West Indies," Chakrabarti briefly mentions the role of piracy in the establishment of Jamaica as a thriving Caribbean economy, but does not provide any further information on the subject of piracy and medicine.

David Geggus' article "Yellow Fever in the 1790s" (1979) provides an in-depth look at yellow fever in the Caribbean during the British campaign on Saint Domingue (present-day Haiti). Geggus uses historical data to come up with mortality rates among different British troops. He concludes that troops landing in the Caribbean from December to April had time to acclimatize and possibly acquire immunity to yellow fever. Geggus further notes that yellow fever was primarily transported from ships that recently visited the west coast of Africa, mostly from slavers traveling between the years 1690 and 1794 (1979:41-42).

John Blake's article "Yellow Fever in Eighteenth Century America" (1968) provides an interesting overview of the transmission and treatment of this virulent disease. Blake addresses both the contagionist and anticontagionist viewpoints of medical practitioners during this period in American history. As the disease was not fully understood, nor distinguished from other intermittent and remittent fevers, towns adopted both quarantine measures and the development of sanitary reforms (proper sewage treatment, municipal cleanliness, urban tree-planting). Blake concludes the article by stating that although both measures improved the overall health of municipalities, the policy of quarantine fell out of favor due to economic pressures.

> … once the doctors had quite generally agreed on the localist theory and quarantines were accordingly relaxed, cities were not, as Rush, Webster, and others had

> recommended, reconstructed for health … The bureaucracy and expense of quarantine were minor indeed to the … expense of adequate sewerage, housing and municipal cleanliness. … I believe it may be safely said that independent medical opinions reached objectively, rather than the needs of commerce or political sentiments, caused the overthrow of contagionism with respect to yellow fever in America (Blake 1968:683).

Both articles emphasize medical practitioners' frequent encounters and treatment of yellow fever on slaving vessels on the Atlantic voyage from the west coast of Africa to the Caribbean or Americas.

All of these sources provide a broad picture of the condition that shipboard medical practitioners faced throughout their time onboard. To combat these diseases and injuries, practitioners were armed with specific instruments and medicaments designed to treat both known and unknown ailments and/or injuries.

Medical Instruments

The tools that have developed over the last five hundred years reflect the specialization of medical practice. By the 16th century, medical practitioners created both single-function and multi-function tools. Historic medical instruments also reflect the trends and popular treatments of their time period, such as instruments for bloodletting, enemas, and trepanning. These can be seen in various archaeological and museum assemblages throughout the world, including *Mary Rose*, *QAR*, and The Mütter Museum in Philadelphia.

Authors William Clowes and John Woodall both listed surgical instruments that medical practitioners should include in their chests (Clowes 1637:110; Woodall 1617:xvi-xvii). The lists

are similar, which is unsurprising as the original published editions of their books occurred a mere two decades apart. However, Woodall's is more comprehensive (Table 1). Though historic, these lists provided medical practitioners with an idea of what objects to take onboard and expect to use throughout the duration of their voyage

TABLE 1: INSTRUMENTS DESCRIBED BY CLOWES AND WOODALL

Instrument	**Definition/Use**	**Author**
Saw	Amputation	Clowes, Woodall
Catlin	Double bladed surgical knife	Clowes, Woodall
Cauterizing Irons	Wound closure or sterilization	Clowes, Woodall
Trepan	Trepanning	Clowes
Head Saw	Trepanning	Clowes
Elevatory	Curved spatula; bone or other small foreign object removal	Clowes
Dilatorium	Dilation forceps; opened wounds further for easier foreign matter removal	Clowes
Ravens Bill Forceps	Trepanning	Clowes, Woodall
Crows Bill Forceps	Bullet extraction	Woodall
Ducks Bill Forceps	Either ear or vaginal surgery	Clowes
Cranes/Storks Bill Forceps	Uterine and/or vaginal surgery	Clowes, Woodall
Speculum Oris	Mouth gag; oral surgery	Clowes, Woodall
Speculum Oris with a Screw	Oral surgery	Woodall
Incision Knives	General surgery	Woodall
Dismembeing Knives	Amputation	Woodall
Razor	General surgery; barbering	Woodall
Dismembering Nippers	Large pliers for rapid amputation of digits	Woodall
Mallet	General surgery	Woodall
Chisel	General surgery	Woodall
Terebellum	Bullet extractor screw	Woodall
Incision Shears	Surgical shears	Woodall
Probes	General surgery	Woodall
Spatulas, large and small	General surgery	Woodall
Spatulum Mondani	Hard excrement removal	Woodall
Clyster Syringes	Anal enemas	Woodall
Small Syringes	Blood or urethral use	Woodall

Catheter	Urethral use	Woodall
Candles	Pharmaceutical	Woodall
Scissors	General surgery	Woodall
Stitching Quills/Needles	Wound closure	Woodall
Lancets	Phlebotomy	Woodall
Cupping Glasses	Phlebotomy	Woodall
Brass Basin	Multipurpose	Woodall
Blood Porringer	Phlebotomy	Woodall
Skillet	Multipurpose	Woodall
Chafing Dish	Pharmaceutical	Woodall
Clyster Pot	Pharmaceutical	Woodall
Funnel	Pharmaceutical	Woodall
Mortar and Pestle	Pharmaceutical	Woodall
Weights/Scales	Pharmaceutical	Woodall
Sieve/Strainer	Pharmaceutical	Woodall
Splints	Fractures	Woodall
Tape	Multipurpose	Woodall
Sponges	Multipurpose	Woodall
Thread	Wound closure	Woodall
Cannisters	Pharmaceutical	Woodall
Cups	Pharmaceutical	Woodall
Bricks	Multipurpose	Woodall
Empty Bags	Multipurpose	Woodall
Leather Skins	Multipurpose	Woodall
Plaster paper	Wound care	Woodall
Plaster board	Wound care	Woodall

Instrument Cases

A note regarding the terms case, chest, and set: these three terms are similar, but not the same. A case refers to any box-like structure used to house instruments; it may have a hard or soft shell, and contain either a general or a specific (such as amputation or bloodletting) set of instruments. A chest refers to a larger, box-like structure that housed multiple instruments, medicaments, and/or other pharmaceutical accoutrements. A set refers to multiple instruments, generally housed in a case, which functioned in concert allowing the medical practitioner to perform specific tasks such as amputation or general internal medicine.

Since onboard medical practitioners traveled, a specialized case for all of their instruments was essential. These chests could contain all their tools, or a specific set, such as the amputation set or bloodletting set (Weston-Davies 1989:40). Generally hinged open like a box, kits ranged from simple to ornate. Chests were made of any sturdy material that would withstand the conditions to which they were subjected: woods, metal, leather, or even sharkskin. These chests were generally lined with velvet or other fabrics to protect and cushion the precious instruments inside (Kravetz 2004:1418; Thompson 1950:275-276, 278).

FIGURE 3. Medicine Chest of Dr. Benjamin Rush (The Mütter Museum Catalog 2016).

Wooden cases (Figure 4) were made by a subspecialty of cabinet-makers and considered an essential part of the instrument making as a whole. Without these customized kits, the precious instruments that they contained would easily become lost or damaged without the protective housing (Weston-Davies 1989:41). Some cases were extremely ornate with reliefs along the entire box, displaying the practitioner's guild, status, and king to which he served. Others, like those found on *Mary Rose* and *Vasa* (1628), were simple in design – just a hewn chest or tub with a lid – without any ornamentation (The Mary Rose 2007; DigitaltMuseum 2015).

Other examples of cases created out of other materials survive in museum collections. During the 1930s, C. J. S. Thompson wrote an article to the *British Medical Journal* concerning a Tudor period instrument case dated to the 1520s. The case was extremely ornate, "made throughout of silver" (which may also be pewter or the like) and gilded throughout. A chain supported the outer edges of the box, and wood and leather lined the inside (Thompson 1931:811).

Bladed Instruments and Amputation Practices

The evolution of cutting instruments comes from the earliest lithic tools. Advances in metallurgy allowed for cutting instruments to move away from lithic tools into contemporary metals. The shape of the blade of all knives, including surgical knives, is function-driven: serrated edges saw through muscle, smooth blades slice skin away, and curved edges are specifically sized for their area of use. Medical sets from the 17th and 18th centuries contained several types of knives, scalpels, hooks, shears, scissors, and generally a single bone saw (Sachs et al 1999:1089).

Amputation is among the oldest and most serious of all surgeries. The amputation knife was a smooth edged tool that easily sliced through skin and muscle. Before the advent of anesthetics, surgeons had less than ten minutes to complete any surgery, including amputations. Thus, an amputation at the thigh could only last three to four minutes because of the nearby arteries. Early practitioners cauterized the blood vessels to stanch blood flow, however, the advent of vessel ligatures by renowned surgeon Ambroise Paré in 1590 reduced the amount of blood lost during amputation (Sachs et al 1999:1088). Personal amputation techniques also dictated the shape of the knives used. During the 16th and 17th centuries, practitioners would kneel to perform amputations, standing up halfway through the procedure while the patient was turned prone onto their back. Therefore, surgeons of this period preferred metal curved blades because they were easier to handle during this 'one-stage circular cut' (Sachs et al 1999:1088-1090).

Another essential instrument for amputation was the bone saw. This was used after the initial cut into the flesh to excise a part of the bone from the body. The teeth of the saw cut through the bone easier than could a straight blade. Bone saws came in many forms; one common variety consisted of a thin serrated edged blade connected on each end to a long handle by thin pieces of metal similar to modern tree saws, while others resembled a butcher's knife with a serrated rather than smooth edge (Goddard 2004:192).

Other bladed tools that evolved from the knife include shears and scissors. Considered to be spring instruments, the metal of shears bends on itself like tongs. They are mentioned by Celsus in the 1st century to "cut hair and to excise prolapse gangrenous *omentum* after abdominal injury" and again are mentioned again in the 6th century by Paulus for circumcisions and penile warts (Kirkup 1998:422). Structurally different,

scissors have a more dubious and early beginning. Like shears, they consist of two sides of blades, but are not a single piece; instead, a central pivot point connects the two pieces. Drawings and paintings of these instruments for use in surgery date from the 11th century, and are attributed to Arabian physicians (Kirkup 1998:422). Until the widespread use of steel, iron was the preferred material type for scissors and shears. Scissors on display at the Royal College of Surgeons of England have steel blades with silver handles and bear a hallmark of 1664 (Kirkup 1998: 424). The 1761 discovery of crucible steel allowed manufacturers such as Sheffield to mass-produce "excellent surgical scissors" (Kirkup 1998: 430).

Glass, Ceramics, and Bloodletting Practices

Medicine or dispensary bottles were made of either ceramic or glass and employed a stopper to seal them. Both glass and glazed ceramic jars were impervious to liquids and could therefore store either dry powder or liquid medicaments (see the section on medicaments for further information on associated instruments). Medicinal jugs found on *Mary Rose* are ceramic with cork stoppers, while the assemblage of HMS *Sirius* (1790) contains both salt-glazed stoneware jars, likely used for medicament storage, and a glass medicine bottle stopper (Jones 2003:112; Stanbury 1994:67).

While medicines could be useful additives, the practice of bloodletting evolved from the belief that within the body there are four humors ruling all bodily functions, and that sicknesses were caused by ill humors that could be released from the body through the draining of bad blood (Schmidt 2006:165; Whitaker et al 2004:134). The instruments used for this purpose included special ceramic or metal basins, animal horn, and metal or

glass cups in a wineglass shape, knives, leeches, and later mechanical leeches (Goddard 2004:195; Weinberg 1994:131).

Cupping was considered the sister to bloodletting as it was often performed immediately before or as a part of bloodletting. Cupping was in use by at least the 18th century as Susan Wheeler includes an engraving done by an anonymous German artist from that era depicting a medical practitioner performing a cupping procedure (Wheeler 2001:123). It involved the use of bell-shaped glasses placed with the open-end directly onto the patient's skin; it could either be performed as wet or dry cupping. Glass cups (Figure 5) were not completely flat on the bottom since the rolled rim allowed for a much better vacuum seal; they were generally made of flint glass and ranged from 1.5 to 2.0 inches in diameter and 2.0 to 3.0 inches in height (Kravetz 2004: 1418).

FIGURE 4. Cupping glass and syringe from a cupping set (The Mütter Museum Catalog 2016).

Used as an anti-irritant and a way to reduce swelling, dry cupping often had the opposite effect. To create the vacuum seal, the cup was either heated over a burner or by placing a burning piece of material (such as wool or linen) in the base of the cup. The

medical practitioner then quickly inverted the glass and placed it on the patient's skin where the negative pressure created suction. Removal of the cup could prove difficult, as "the suction could be so great that …when the glass was in position for longer than a few minutes, pain followed by black and blue wheals was caused by the extravasation of blood from small vessels" (Wand-Tetley 1956:90).

Unlike dry cupping, wet cupping was another way to initiate bloodletting. Using a small scalpel, a cut on the patient's skin allowed blood to free-flow. Then, the practitioner placed four cupping glasses over the area to drain up to 20 ounces of blood (Wand-Tetley 1956:90). The assemblage of HMS *Sirius* (1790) contains the rim shard of a cupping glass, from a set of three; cupping glass shards are also among the assemblage of an historic convict hospital on Norfolk Island, Australia (Stanbury 1994:67).

Several accessories became an essential part of wet cupping, including the mechanical scarificator made of either silver or brass. This device, invented by Ambroise Paré in the seventeenth century, reduced the amount of time spent cutting the patient open prior to cupping. Similar in design to a coffee mill, a turn of the scarificator's handle (or later a released spring) would cause a battery of blades to turn and cut into the patient quickly and efficiently (Wand-Tetley 1956:90). These blades, called lancets, could be raised or lowered into place, thus giving the operator control on the depth of the cuts and essentially the rate of blood flow in the patient (Dickenson 1917: 91).

Although modern lancets are synonymous with scalpels, there is an historic difference between scalpels and lancets. Used in surgical procedures, especially in amputation, scalpels cut into and removed flesh from the body. Lancets were, however, employed solely in bloodletting procedures, generally cutting into areas such as the inner

elbow, stomach, and back (Wheeler 2001:122-125). The scarificator's blades are specifically described as lancets, rather than any other type of knife, demonstrating this difference in usage.

Another tool associated with cupping is the spirit lamp, which was used to heat the cupping glasses. Like the scarificator, it was generally made of brass or silver. Cotton wick or wadding dipped in "spirit" (such as oil) provided fuel for the flame. The lamp was configured so that the "spirit" remained in the bottom of the lamp, and the wick protrudes to the top – adjusted by a small lever on the side that when twisted in either direction would raise or lower the wick (Dickenson 1917:92-93; Thompson 1954:492-493). Samuel Bayfield's 1823 article entitled "A Treatise on Practical Cupping" describes the use of the spirit lamp in cupping stating: "'The wick of the torch was now … lighted … and carried under the glass to its centre, where it was allowed to remain for about two seconds, and it was then withdrawn quickly'" (Dickenson 1917:92).

The use of leeches was another popular method of bloodletting. The first recorded use of leeches for this purpose was in ancient Egypt and can be seen on the "wall paintings found in sepulcher of the 18th dynasty pharaohs (1567-1308 BC)" (Whitaker et al 2004:134). The word leech is derived from the Anglo-Saxon *laece*, meaning, "to heal" or "healer" (physician) (Weinberg 1994:131). Medical practitioners kept leeches in liquid-filled jars – first ceramic, then glass – with perforated tops so that the organisms could survive. Considered less painful than that of a scalpel or scarificator, leeches were generally the preferred method of bloodletting (Whitaker et al 2004:134-135).

Medical practitioners also used a special type of bowl for bloodletting known as the porringer. This type of bleeding was both common and painful. The porringer was a

shallow, medium sized bowl made of ceramic or metal, that generally had a wide rim and a circular cut in the rim. Placed under a patient's arm (with the elbow in the circular cut), the bowl caught blood drained during the procedure (Wheeler 2001: 122-123). A good example of a metal porringer comes from the assemblage of *Mary Rose* in which a shaving bowl/porringer from their barber-surgeon was found. This object is one of many that confirmed documentation of the presence of a medical practitioner onboard prior to the ship's wrecking (Gardiner 2013:200-203).

As previously mentioned, bloodletting is visually represented in the section entitled "Phlebotomy" in *Five Hundred Years of Medicine in Art* through several woodcut prints, pen and ink drawings, etchings, and lithographs (Wheeler 2001:122-125). Writing about a bleeding bowl from the collection at the Royal College of Surgeons, William E. Thompson states that it is "perhaps the oldest in the exhibit … It is made of pewter … Stamped on the bottom is a dove bearing a branch in its mouth, the letters R. B. and the date 1671" (Thompson 1954:490).

Other Materials and Devices

A medical practitioner could carry a large battery of metal and composite material instruments such as lancets, the *cautery* – a term used to distinguish between the instrument and its application with the use of caustic materials, and syringes. The shape of syringes was function driven and sizes ranged from the small vaginal, urethral, and blood syringes, to large clyster syringes. Small enough for a pocket, vaginal and urethral syringes were generally made of pewter and used to administer the medicine needed to treat venereal diseases and yeast infections (Goddard 2004:196). Also made of pewter,

clyster syringes (Figure 6) were larger and used to administer enemas. Interestingly, some clyster syringes doubled as urethral syringes (Goddard 2004:196). Several pewter syringes recorded at the *QAR* site include clyster syringes (Jarus 2015:2).

FIGURE 5. Part of a clyster syringe. (Photo by Jeremy Borelli; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

Specialized blood syringes were made of either metal or a composite of metal and glass, and gained use by the 19th century. Used in bloodletting in conjunction with mechanical leeches, and later with blood transfusion, common metals for blood syringes include pewter and brass (Thompson 1954:492-493). Like amputation kits, blood syringe kits had many accouterments that included in the box with the syringe, such as the actual needle and a metal funnel (Thompson 1954:492).

Cautery refers to the instrument used to apply intense, local, direct heat to an injured person. Commonly made of iron and spherical or prismatic in shape, the medical practitioner would heat the iron until red-hot and apply it to the patient's skin. Cauteries were used to treat various diseases and wounds such as gout, sciatica, and limb amputation. Like bloodletting, people believed that the heat from the cautery would put

the humors back into balance, or let out the demons causing the disease, thus healing and punishing the patient simultaneously (Wand-Tetley 1956:93).

Medicaments

The term *medicament* refers to both the ingredients and the fully formulated medicines/ointments/tinctures administered by the medical practitioner. As this term is used in the contemporary historic documents, it will also be used for this study instead of the modern term "medication". Instruments associated with medicaments include ceramic and glass bottles or jars with lids or corks, mortars and pestles, bowls, and weight systems. Each of these categories are readily found in most of the aforementioned assemblages, including *QAR* and *Mary Rose*.

In addition to the diagnosis of ailments, practitioners created treatments according to their own medical training using ingredients and compounds readily available at the time. Much like a modern pharmacist, the shipboard medical practitioner would weigh out, crush, and mix specific ingredients in accordance with their learned or researched prescriptions. In the section regarding the treatment of *Lues Venerea*, William Clowes provides many prescriptions and recipes for compounds to relieve the symptoms of syphilis (Clowes 1637:145-220). Though these instructions appear to be quite foreign to a modern reader, contemporary practitioners read these with great understanding (Gardiner 2013:171-172).

Included in Clowes' book is a final section entitled "The nature and propertie of Quicksilver, by G. Baker one of her Maigesties Chirugions" (Clowes 1637:226-229). Further reading is recommended for those who wished to undertake more research on

quicksilver (mercury), including works by Aristotle and Galen stating: "…for read Galen, in his fourth booke *De simplicibus*, and there you shall see the [answers]. Also reade (sic) Aristoteles' *Meteor*, Halibus, Paule … and ye shall be fully satisfied" (Clowes 1637:228). This demonstrates that medical practitioners were encouraged to review historic, known methodology/treatments as well as those of contemporary practitioners, thus advancing the knowledge of medicaments.

John Woodall touches on the unique nature of medicaments in the practice of shipboard medicine throughout *The Surgions Mate* (1617). For example, the chapter on scurvy not only describes the ailment and its many symptoms, but also provides specific medicaments (lotions, oils, and unguents) and how to administer to be most effective (Woodall 1617:181-202). He also prescribes a treatment, later recommended by Dr. James Lind in *A Treatise on Scurvy* (1772), regarding the prevention of scurvy on long voyages saying:

> Further the Surgeon and his Mate must not faile to perswade the Governor or Purser in all places where they touch in the Indies and may have it, to provide them-selves of juice of Oringes, limes, or Lemons … (Woodall 1617:185).

Thus, this early 17th century manual not only helped medical practitioners recognize the symptoms of common ailments onboard ships, but also provided information regarding contemporary treatments and preventative measures.

Woodall's final sections in *The Surgions Mate* (1617) deal with standardized symbols for medicaments; definitions of common terms used throughout the manual; and

individual medicaments, such as salt, sulfur, and mercury. With each of these, he included poetic verses that helped the medical practitioner understand the use and side effects of these medicaments.

> … Great store of food is gain'd by salt,
> all things it savory makes.
>
> In Physicke and Chirugerie,
> it hath the greatest part:
> It doth containe an essence true,
> which glads the fainting heart.
>
> It causeth appetite at neede,
> it quencheth thirst at will:
> It ceaseth paine of raging gowts,
> it fevors hot doth still.
>
> Thereby are bleeding wounds made well,
> and that without delay:
> Yea soridid ulcers it makes sound,
> and tumors takes away… (Woodall 1617:291).

Summary

Understanding maritime medical history is necessary to appreciate the broad scope of the role and education of the shipboard medical practitioner. Knowledge of historic medical practices at sea and access to surgical instrumentation provides insight into better understanding how practitioners fulfilled their duties onboard. It is with this history that one may begin to ponder the relationship between the practitioner and their instruments, and how this is reflected in physical assemblages throughout the world. This history information provides a foundation to further understand the relationship between the practitioner, medical treatment options on ships, and the prescribed array of medical instruments commonly used. The next step is to make the connection between the historical record, artifact assemblages, and the archaeological record.

Chapter 3: Theory

This thesis will use material culture theory to explore the themes of medical instruments as a means of communicating the culture surrounding the instruments, the objects' owner(s), the role that the instruments played in the care of patients, as well as how the instruments relate to each other, to specific cultures (maritime, medical, national identity), and to the individual researcher. This thesis will use the material culture theory and methodology to examine and analyze the assemblages to glean further insight into the differences and similarities to medical practice onboard naval vessels, mercenary vessels, and those medical practices based on land. It will also use pattern recognition to establish general and specific categories of objects, allowing for a comparative analysis of the datasets.

Material culture theory is broad and encompasses many areas of research the in disciplines such as anthropology, museum studies, and sociology. However, this theory and its corresponding approach are essential to researching and understanding cultural heritage objects. Material culture theory and the accompanying approaches allow researchers to fully interact with and study the objects on many different levels, allowing for successful cross-cultural and other comparative analyses (Prown 1982; Tilley et al 2006; Knappett 2005; Hurcombe 2007; Hodder 2012).

Pattern recognition in historical archaeology was first described by Stanley South (1978a, 1978b, 1979). It involves using of datasets recovered from sites to establish patterns, both intra- and inter-sites (between cultures divided spatially, economically and/or temporally). Therefore, it is an essential part of producing effective comparative analyses between datasets, and will be discussed in this chapter in brief.

It is important to note that this thesis deals primarily with material culture assemblages from laboratory or museum collections, rather than archaeological contexts. However, provenience plays an important role in the analysis of these objects. Additionally, as researchers recovered many medical artifacts from shipwreck sites with recorded provenience, more traditional archaeological theories (such as Marxism, semiotics, New Archaeology, or structuralism) may also be helpful in analyzing the physical archaeological sites rather than the material culture.

Material Culture Theory

Though rarely written about, the intent of material culture theory is to guide or provide a framework for researchers to examine cultural heritage objects in a scientific and objective manner. Theory, used in conjunction with a specific methodology, can garner the most information about the thought process of the manufacturer and the user from each individual object. First described by Jules David Prown in "Mind in Matter: An Introduction to Material Culture Theory and Method" (1982), the paper states that:

> It is a means rather than an end, a discipline rather than a field … Material culture as a study is based upon the obvious fact that the existence of a man-made object is concrete evidence of the presence of a human intelligence operating at the time of fabrication (Prown 1982:1).

Material culture theory builds upon other well-published theories such as semiotics, Marxism, determinism, and structuralism – hereafter referred to as founding

theories. Prown describes material culture theory as "the object based aspect of the study of culture" (Prown 1982:5) Furthermore, he states that the purpose of this theory is to understand the cultural belief systems and patterns of specific groups of people, and that through the careful study of objects, one can perceive the cultural universe in which an object was created (Prown 1982: 5-6). By combining these ideas, Prown was able to establish a theory that others could use to frame questions specific to material culture studies.

Guy Gibbon's *Anthropological Archaeology* (1984) indirectly addresses the needs for using comparative analyses as a means of answering larger questions surrounding culture. Gibbon's work describes the reasons for using objects as a means of exploring and understanding the human condition. "Cross-cultural comparisons become possible when we concentrate on what is shared in these situations, rather than on what is unique" (Gibbon 1984:312). And by focusing the attention on several material culture assemblages in the manner described by Gibbon, a shared experience between all of the medical practitioners becomes evident.

Gibbon's cross-cultural comparison, coupled with pattern recognition described by Stanley South, provides a foundation for further research when used as a methodology in comparative analyses. Gibbon does not attempt to explain material culture theory in his book. However, it does have a place within anthropological archaeological approaches, as proven by many other authors discussed here.

The *Handbook of Material Culture* is an in-depth look at the relationship between material culture theory and its application in the fields of anthropology, archaeology, art, design, museums, and conservation (Tilley et al 2006:7). As a collection of essays, the

book delves into the many different founding theories that comprise material culture theory. Perhaps the best description of the relationship between the founding theories is in the section on the structuralist and semiotic approach:

> Things are meaningful and significant not only because they are necessary to sustain life and society, to reproduce or transform social relations and mediate differential interests and values, but because they provide essential tools for thought. Material forms are essential vehicles for the … self-realization of the identities of individuals and groups because they provide a fundamental non-discursive mode of communication. … Artefacts, from such a perspective, are signs bearing meaning, signifying beyond themselves. Material culture becomes, from a structuralist perspective, a form of "text", something to be read and decoded, its grammer revealed. (Tilley et al 2006:7).

This statement gets to the very heart of material culture theory and briefly addresses implications behind the specific methodologies originally outlined by Prown (1982).

The *Handbook of Material Culture* (2006) also provides case studies regarding the use of material culture theory and how it was especially helpful in interpreting the different types of material culture. For instance, Jane Schneider's chapter entitled "Cloth and Clothing," describes the different aspects of the effects of textiles on societies from the spiritual to capitalistic (Schneider 2006). Schneider begins by stating that textiles "constitute … the widest imaginable category of material culture" and that these objects represent society on a cultural, political, and economic level (Schneider 2006:203). She

delves further into textiles by examining them in specific topics such as the spiritual aspects, artisan production, consumption, and the dynamics of fashion. In doing so, Schneider is able to relate the various ways that humans, society, and textiles interact in both a modern and historic context. For example, she discusses the cultural and religious impact and implications of a traditional Indian garment known as a sari by stating:

> Emblematic of pride in the nation, the sari has convinced all classes of women … that it augments their "possibilities of aesthetic, beauty, female mastery, sexuality and the cult of the maternal". … Because the sari's potential to evoke sexuality has triggered the sort of anxiety that attaches to trendy, consumerist clothes, however, some [modern] Indian women prefer the Muslim-influenced *shalwar kamiz*, a garment of trousers and tunic that hides, rather than reveals, the body (Tilley et al 2006:215).

The case studies in this chapter reflect Schneider's thought process and interpretation of the documentation and objects, proving the research capability of this theory (Schneider 2006:203-217).

Russell J. Barber's textbook *Doing Historical Archaeology* (1998) aims to explain the practical applications of theory. Though it is not explicitly used, material culture theory permeates through several of the sections, including "Exercise 8: Social Analysis of Architecture." Barber encourages students to examine and interpret the structures of two buildings including the attitudes and behavior patterns they might reflect (Barber 1998:75). To provide this interpretation, the students will think about how the buildings

would affect the peoples of that period. The textbook provides the relevant data regarding the two example houses and encourages students to provide a comparison of the social implications of the two houses (Barber 1998:77-78). In doing so, the students may use the available data to imagine themselves as a part of that particular culture and interpret the buildings in that manner. If they use this approach, the students have unknowingly used material culture theory without explicit instruction to do so.

The well-known archaeological theorist Ian Hodder also addresses the need of material culture theory in his *Sage Biographical Research* chapter entitled "The Interpretation of Documents and Material Culture" (2012: 171-187). In it, Hodder (2012:174) expands on existing material culture theory stating that the study of material culture is especially important for those who wish to examine multiple and conflicting voices as well as "differing and interacting interpretations" in their qualitative research as areas of culture; that the overall human experience is not completely explained using languages; that the analysis of material traces of daily life should not be viewed as trivial; and that "material culture is not simply a passive by-product of other areas of life. Rather material culture is active."

Hodder continues on with the importance of this theory and methodology saying, "Ultimately, material culture always has to be interpreted in relation to a situated context of production, use, discard, and reuse" (2012:175). Like Prown (1982), Hodder encourages the distinction of overall characteristics and typologies of material culture through physical analysis, as the experience of objects can vary greatly between researchers as humans and their individual life experiences are diverse; this diversity is just as great in material objects (2012:176-177). Hodder also understands that:

> [T]he interpreter of material culture works between past and present or between different examples of material culture, making analogies between them. The material evidence always has the potential to be patterned in unexpected ways. …On the other hand, material culture is the product of and is embedded in "internal" experience. Indeed, it could be argued that some material culture … may give deeper insights into the internal meanings according to which people lived their lives. … The interpreter is faced with material data that are patterned along a number of different dimensions simultaneously. … In other words, the analytic or pattern-recognition stage has itself been identified as interpretive (Hodder 2012:181).

This statement reflects the harmonious use of material culture theory and pattern recognition.

Both Hodder (2012) and Prown (1982) discuss three-pronged methodologies for analysis of objects. Both are important to the interpretation of objects in material culture theory; Prown's methodology will be discussed first. Prown insists that the objects' initial examination be objective in a manner that mirrors hard sciences such as geology, thus allowing the scientific method to permeate all aspects of the methodology assist in answering the culturally significant questions posed by the researcher. Firstly, the description of the object is restricted to what is physically observable, the "internal evidence" (Prown 1982:7). Descriptions must be terminologically accurate yet understandable by those not fully versed in technical jargon. The analyst must continually

be aware that since the object is examined at a specific point after its manufacture and primary use-life, outside forces such as weathering and wear patterns or recycling and repurposing of an object may alter its look and will be readily observable (Prown 1982:7).

During the second deductive phase, the analyst contemplates the relationship between themselves and the objects they examine all while thinking about "what it would be like to use or interact with the object," allowing for physical interaction with the object, if possible (Prown 1982:7). Prown expands this into three distinct types of deduction that explain how the analyst interacts with the object: sensory engagement, intellectual engagement, and emotional response (1982:8-10). Through this, Prown encourages the analyst to physically engage with the object, think about how the object was used or perceived, and explore their emotional response to the object itself.

Finally, Prown describes the speculative stage of the methodology wherein the analysis moves from what is physically observed and experienced to what the analyst can speculate about the object. Prown states:

> There are a few rules or proscriptions at this stage. What is desired is as much creative imagining as possible, the free association of ideas and perceptions tempered only, and then not too quickly by the analyst's common sense and judgment as to what is even vaguely plausible (Prown 1982:10).

By considering these factors, the analyst can perceive some of the possibilities of the object's initial use and the culture that used it. The methodology, though rigid, went

through different interpretations by other researchers (Tilley et al 2006; Knappett 2005; Hurcombe 2007) including Ian Hodder (2012), and provides the general outline to the thought process during the analyses of objects in this thesis.

Like Prown (1982), Hodder's (2012) methodology for material culture theory is also divided into three parts. First, the researcher must understand the commentary surrounding the material objects, and decide if they should take these at face value. They must also understand how to evaluate both verbal and non-verbal responses to the objects examined (Hodder 2012:180). As previously discussed, the researcher's analysis relies on analogies drawn between the past and present or between different material culture examples. Hodder explains that:

> [P]hysical traces and separations might assist the definition of contextual boundaries such as the boundaries around a village or the separation in time between sets of events. … But despite such clues there is an infinity of possible contexts … The notion of context is always relevant when different sets of data are being compared and where a primary question is whether the different examples are comparable, whether the apparent similarities are real (Hodder 2012:181-182).

Next, Hodder (2012) explains that in addition to recognizing the role of context in interpretation of objects, the researcher must also recognize the comparative and contrasting qualities of the examined material culture or data. Hodder states "The interpreter argues for a context by show that things are done similarly, that people

respond similarly to similar situations, within its boundaries" (Hodder 2012:182). This is especially significant in the context of examining medical material culture as high-pressure life-or-death situations provide this idea of responding similarly throughout time. Preparation and training provide the backdrop to the responses of the medical practitioners discussed in this thesis.

Finally, Hodder (2012) discusses the necessity of discovering the appropriate theory for interpretation of material culture. By understanding theoretical choices, the researcher can provide the best interpretation of the physical data. Hodder continues stating:

> Observation and interpretation are theory laden, although theories can be changed in confrontation with material evidence in a dialectical fashion. … The more specific theories include the intentions and social goals of the participants, or the nature of ritual or cultic as opposed to secular or utilitarian behavior (Hodder 2012:182).

These two methodologies, described by Prown (1982) and Hodder (2012), provide basic outlines with which researchers can use material culture theory when analyzing objects either physically or virtually available (such as a dataset).

Material culture theory readily allows for comparative analyses of assemblages. The cultural heritage that remains after its initial use-life can invariable be used again to answer questions regarding the initial people(s) who used the object(s), and researchers

can use their own personal interactions with these objects to attempt to answer these questions.

Pattern Recognition

Hodder's (2012) interpretation provides a bridge between material culture theory and the pattern recognition theory and methodology discussed by Stanley South. Considered the father of Historical Archaeology, South's (1978a, 1978b, 1979) work on pattern recognition is characterized by the research of intra and inter-site patterns to "explore site function, chronology, structure as well as status, trade routes, ethnicity, settlement patterns, frontier phenomena, and environmental variables" (South 1978a:223). He also advocates for the use of historical documents to "derive some degree of independent control … against which archaeological patterns can be projected for exploring the relationship between past behavioral processes and the archaeological record" (South 1978a:223).

Using datasets from historic sites, South explained the process of pattern recognition in order to understand the "distribution frequencies and quantitative relationships between artifact types, classes and groups" (South 1978a:223). South uses the example of discovering the mean manufacture date for British ceramics on an 18th century historic site as a way of understanding patterns in both archaeological sites and material culture use (South 1978a:225-226). This theory allows researchers to successfully find patterns within comparative assemblages.

South continued publishing his work on pattern recognition, and it has become a part of the taught methodologies of historical archaeology used by students for

comparative analyses (South 1978b, 1979). The fourth section of Barber's textbook *Doing Historical Archaeology* focuses on teaching students how to recognize material typology and patterns within datasets, using statistical quantitative methods (Barber 1998:125-190). The final exercise in this section demonstrates the significance of understanding and analyzing functionality of artifacts within a dataset. Barber states:

> Not every artifact has an obvious or unambiguous use. … Certain artifacts may go unmentioned because they were so common that everyone knew their use, because they dealt with tasks that polite people wouldn't write about, or because they were used primarily by people that literate recorders didn't find worth writing about (Barber 1998:181).

Barber goes on to explain the necessary categories to consider when preparing pattern recognition in functionality analyses such as form, material, context, wear, and residues (Barber 1998:181-183). Thus, the researcher can formulate categories specific to their datasets that fall within these more general categories, and can determine patterns, such as functionality, for their objects.

Summary

Theoretical approaches and their corresponding methodologies allow researchers to work within the confines of a specific set of rules regarding their datasets. Nonetheless, theory is an ever-expanding field. This is demonstrated by the expansion of Prown's (1982) original ideas regarding material culture theory across multiple disciplines of

research (Knappett 2005; Tilley et al 2006; Hurcombe 2007; Hodder 2012). By combining theories, pertinent information directly related to researchers' questions can be answered.

Chapter 4: Methodology

This study of medical instrumentation will compare historic and archaeological/conservation/museum primary sources, peer-reviewed secondary sources, agency report gray literature, and first-hand experiences with some objects. In addition, due to restricted time and budgetary constraints, accession and curation records and assessment notes on the objects compiled by other researchers will be consulted in order to compare three medical assemblages spatially and temporally separated.

Historical Research

There is a paucity of historical information regarding the role and instrumentation of shipboard medical practitioners. Information used for this thesis came from both primary and secondary sources that dealt directly with medical practices during the 16th through 19th centuries. This era was chosen, as it not only reflected the time period in which each of the assemblages fall (*Mary Rose* 1545, *QAR* 1718, The Mütter Museum 1770-1890), but most of this period is prior to the age of medical enlightenment (mid 18th century). From the 1750s onwards, medical knowledge expanded and instrumentation changed at a rate not previously known. This was partially due to the expansion of dedicated medical centers of learning and increased warfare throughout Europe and western Asia that advanced medical science simply through necessity (Fu 2000).

Primary sources consulted for this study included early books of medical practice, professional correspondence of contemporary physicians, contemporary artwork depicting medical practitioners and instruments, memoirs of physicians who served on

buccaneer/pirate ships, as well as the ship's logs and depositions from the crew of *La Concorde* (later *QAR*) after their return to France (Ernaut 1718); these depositions speak to the number and nature of persons pressed into service by Edward Teach, known infamously as Blackbeard. Early books of medical practice include William Clowes' *A Profitable and Necessarie Booke of Observations* (1637) and John Woodall's *The Surgions Mate* (1617), and William Mountaine's *The Seaman's Vade-Mecum and Defensive War by Sea* (1761), are available through web-based resources such as Early English Books Online that provide scanned copies of originals or re-prints of manuscripts. These primary sources contained information necessary to understanding medical training, treatments, relationships, expectations, and contracts during this period.

The artwork from this period is available in compilations such as Susan Wheeler's *Five Hundred Years of Medicine in Art* (2001) and as illustrations from historical works such as *Anglo-Saxon Leechcraft* compiled by the Burroughs Wellcome Company (1912). Artwork reflects artists' interpretation as well as actual practices. In conjunction with the other primary sources and viewing all of the art with a discerning eye, it is possible to understand the difference between a depiction of historic life and an artist's interpretation.

The professional correspondence of contemporary practitioners in the form of medical journals or logs gave a daily, monthly, or annual report of the onboard medical practices. These are available as compilations from national, state, and naval archives. One such collection is from the British Royal Navy entitled *Shipboard Life and Organisation, 1731-1815* (Lavery 1998). Though slightly outside the period of shipwrecks examined in this thesis (1540s-1720s), the medical logs contained in this

volume provide valuable insight into how British practitioners treated their patients during naval voyages.

Secondary sources for this thesis primarily consisted of books written about the history of medicine and medical instruments. One such book, *Medicine Under Sail* by Zachary Friedenberg (2002), provides insight into historical medical practices at sea, specifically on naval vessels. Topics explored in the book include preventing and treating common onboard diseases such as scurvy, those found at ports such as typhus or other tropical diseases, and diseases associated with the slave trade. Friedenberg also discusses individual medical practitioners, both the well-known such as John Woodall and James Lind, as well as others such as John Milne who had excellent ideas on how to improve shipboard health on long voyages (Friedenberg 2002:10-15, 43-47, 53, 57-59, 103-104).

Books such as Brockliss and Jones' *The Medical World of Early Modern France* (1997) and Prioreschi's comprehensive five-volume set entitled *A History of Medicine* (2007) provide an in-depth look at historical medical practices in Europe. Though not specifically concentrated on shipboard medicine, these books are essential to the understanding of the techniques, practices, and theories used by onboard medical practitioners during the period under study. This information provides context for the objects found in each of the assemblages investigated in this thesis. It also helps make sense of primary documents that, without this historical background, can become a muddled mess of antiquated medical terms.

Published sources give a broad picture to the general knowledge of each archaeological site. For example, each of the four volume series *Archaeology of Mary*

Rose produced by the Mary Rose Trust focuses on different aspects of *Mary Rose* such as history, conservation, and ship construction.

Other sources included gray literature from *Mary Rose*, The Mütter Museum, and *QAR* including photographs and conservation notes (Kate Shuttleworth 2016, elec. comm; The College of Physicians of Philadelphia 2015; George Grigonis 2015, elec. comm.; Courtney Page 2016, elec. comm.; North Carolina Department of Natural and Cultural Resources 2016). These were available through contacts at each of the housing institutions: Mary Rose Trust, QAR Laboratory/State of North Carolina, and The Mütter Museum. Other valuable information used in the analysis includes the object's color photographs and line drawings along with X-Radiography of object concretions from the *QAR* wreck-site.

Material Culture Analysis

For the purposes of garnering further analytical insights regarding shipboard medical practices, three assemblages of medical instruments were used, two of these from the highly publicized shipwrecks *Mary Rose* (1545) and *QAR* (1718). Both assemblages were chosen due to the level of accessibility to the collections, either in-person or electronically, and the medical items contained in each. The final assemblage is a selected collection from The Mütter Museum in Philadelphia, which specializes in medical history and instruments. The museum's Collections Manager, George Grigonis and other members of the collections staff specifically curated their collection to reflect the material found in the other archaeological assemblages. Though the archaeological assemblages are spatially and temporally separated, the changes in medical

instrumentation during this period between shipwrecks (1540s-1720s) were minimal, as similar objects were found in both archaeological assemblages. Therefore, a determination as to the medical practitioner's preparedness for what they might have encountered could be made.

This analysis relied heavily on the analysis of the objects as an historical dataset to glean as much information as possible while minimizing time and expense. First, historical, archaeological, conservation, and museum data (as available) about each of the assemblages was compiled and winnowed (as needed). The information pertinent to this thesis was then compiled into a chapter on the history of maritime medical practices and medical instruments, and a chapter of individual case studies that are addressed later in this work. These case studies provide the basis for the analysis.

Each case study begins with a brief historical and/or archaeological background on the assemblage. The included historical and archaeological information provides context. For instance, understanding the provenience of an object at a wreck-site, in relation to other features or objects found on site, can further indicate the object's use. The case studies then address the actual individual objects in each of the assemblages, compiling known data into useful summations regarding known and potential usage, ownership, and significance. Material typology, quantity, and maker (if known) can help trace the objects and further answer one of the secondary questions of this thesis. This data is also available in table format in the appendices. Understanding these assemblages through the use of case studies provides further context for the analysis of the assemblages.

This portion relied heavily on the notes and observations of other researchers for inaccessible assemblages as well as the historic datasets. Their interactions with the objects provided further insight into the objects' function. It is difficult to interact with and analyze objects without having some thought of how the researcher might use the object if they were using it during its initial use-life and as representative of the larger cultural context. Therefore, using the primary and secondary sources, considerations and determinations regarding each instruments' likely use during the course of its original use-life were made.

Medical instruments in each of the collections were analyzed for both single and multi-function use in medical practice as well as quantity within the assemblage (statistical significance), when possible. Instruments such as needles, scissors, and knives – instruments with overlapping functions – were considered as such and analyzed within medical usage. Size or size extrapolation, material composition, and chemical residues (if available) were used to determine possible onboard function. The analytical data was then coupled with historical records to help determine instrument usage, onboard medical needs, and general health of the crew of each ship.

The object tables found in the appendices of this thesis aided with the statistical analysis of the assemblages individually and comparatively. Usage categories created easily compared percentages between each of the objects. This allowed for a determination as to what the medical practitioner actually treated, as well as provide clues to forethought and preparation for other medical maladies, such as tropical diseases, syphilis, or tuberculosis.

When using objects from multiple sources, multiple terms with similar meanings come into play. In dealing with both museum and archaeological collections, the two terms most often used to describe where an object comes from are *provenience* and *provenance*. The museum *provenance* deals directly with the lineage of an object (i.e.: known ownership or origin of creation) whereas the archaeological *provenience* relates to the exact location the object was found on an archaeological site and provides context.

The provenience of the archaeological objects on each site helped create context as to the possible use of the objects during its use-life and any scatter that may have occurred during the wrecking or site formation processes. Using site maps to determine the precise location and grouping of objects, along with historical records, can either confirm or question the presence of medical practitioner onboard prior to the wrecking event. Therefore, the provenience category on each of the tables was essential to the analysis of the medical assemblages.

The provenance category for the selected collection from The Mütter Museum was included to provide context of ownership, maker, and/or geographical location of use. Though primarily American-made instruments, this category demonstrated that it was possible to have overlap between instruments used to practice medicine onboard ships and those used in land-based practices.

Summary

Using a specific methodology allows researchers to explore their topic and answer specific questions. Often, established methods are combined to create the most effective research design and garner the most information from the data. Historical research into

the used of medical instruments and maritime medical practices created a working knowledge from which all other aspects of this research is based. It was combined with the categorization method from South's (1978a, 1978b, 1979) pattern recognition theory as well as the sensory contemplation and research method of material culture theory to answer questions regarding the three assemblages analyzed in this thesis.

Chapter 5: Assemblage Case Studies

In order to compare assemblages, each assemblage was first considered individually. Pertinent historical and archaeological data were considered so that any and all possibilities are accounted for. Since the histories from each of the archaeological sites have extensive and exhaustive published research, what follows are abbreviated histories and descriptions of the medical instruments found in each of the assemblages used for analysis. Therefore, this section will briefly reflect on the relevant aspects of each of the sites' histories and focus primarily on their medical assemblage(s).

Mary Rose

Mary Rose was an English warship built during the reign of Henry VIII, and was in service from July 1511 until 19 July 1545 (Marsden 2003:1-3; Marsden 2009:1, 3-5). It was not unique for the time period; however, the remains of *Mary Rose* comprise one of the most intact examples of an English carvel-built ship in the 16th century. In service for over 30 years, the ship wrecked during the naval battle between the English and French off of Portsmouth, England (Marsden 2009:12). Peter Marsden's *Sealed By Time* (2003) includes his interpretation of both the historic documents and archaeological reports in an effort to determine the cause of the sinking. Guns recovered during the 19th and 20th century efforts provide evidence that allowed Marsden to determine that since there was time to reload after firing, this "would explain why the gunports were left open, in that the ship was *not* trying to turn when she sank. It was the great weight of guns and an unexpected wind that heeled her over" (Marsden 2003:20).

Mary Rose was in the heat of a battle and had on board a full complement of crew, estimated at 415 persons (Gardiner 2013:515-516). The crew most likely included a medical practitioner. During the excavation and research of the vessel, the archaeologists took note of a cabin believed to be occupied by the barber-surgeon, indicated by a chest containing medical instrumentation and medicaments, as well as other associated objects throughout the cabin (Marsden 2003:119; Gardiner 2013:189). The cabin was located on the starboard side (Appendix I) and the chest included a porringer, syringe, pottery and glass bottles (Marsden 2003:119). Appendix I contains site plans, object images, and assemblage tables of *Mary Rose*.

Considered a remarkable find, "the chest was found surrounded with compacted clay and was thus preserved intact" allowing researchers to more fully understand the medical care onboard *Mary Rose* (Gardiner 2013:189). Listed and described in Julie Gardiner's *Before the Mast: Life and Death Aboard the Mary Rose* (2013) are the contents from the chest and other medical-related objects from the cabin. Eleven of these items are unidentified/unassociated handles, assumed to be a part of other larger instruments that corroded away during the years the artifacts were *in situ* (Marsden 2003:119; Gardiner 2013:189-190).

To begin, the chest (Appendix I) itself is a key indicator as to the status of the onboard medical practitioner; it has dovetailed joints, and is made of walnut with elm handles and beech battens – small pieces of wood that provide support to strengthen the overall construction. Though no decorative elements survived the underwater environment, these other elements are key indicators that the chest was an expensive item, leading researchers to the conclusion that the barber-surgeon held a high status

(Gardiner 2013:189). However, a roughly hewn chest made of local or cheap wood(s) with no decorative elements may be a contra-indication of high status.

The razors, knife, and whetstone account for all of the bladed instruments/accouterments contained in the chest. These items, though they may be associated with the barbering aspect of this practitioner's job, could serve a dual purpose. The razor handles (Appendix I) are solid on one end, split throughout the rest of the handle (allowing for the insertion of the razor), and would have had a pin inserted through the split end to provide a pivot point for the blade. Although the handles are all that remain, evidence of the iron blades remains as staining or concretion (Gardiner 2013:217).

Likewise, a pewter porringer (Appendix I) could also have several functions. Found in the barber-surgeon's cabin rather than the medical chest, the object (catalog number: 80A1625) is a "small, shallow bowl, slightly mis-shapen, with a domed centre…and may have been a drinking or eating vessel…" though the researchers go on to say that similar French bowls from this date are referred to as bleeding bowls (Gardiner 2013:200). Again, this could indicate several things. First, the bowl served as multi-purpose (including medical instrument) during its initial use-life; space on ships is scarce and objects must function in many ways to justify the objects' necessity onboard. Second, the bowl only served a single function, and it was either medical or non-medical; in either case, the lack of further evidence keeps the bowl in the possible medical category. Third, the bowl's initial use-life was such that it had no association whatsoever with the medical practitioner and it is mere coincidence that it was in the barber-surgeon's cabin. However, this third possibility is the least likely of the three due to its

provenience and the knowledge of barber-surgeon's bleeding practices; therefore, the bowl will be analyzed as a part of the medical collection. The assemblage also contains a shaving bowl made of brass. Shaving bowls could double as a porringer as they were similar in shape. Like a porringer, this shallow bowl has an indentation in the rim: a place where the chin rested during a shave.

The *Mary Rose*'s medical practitioner also had several pewter items: the previously mentioned porringer; three canisters (Appendix I) that likely held non-corrosive, dry medicaments; three flasks with screw caps that held non-corrosive oil or liquids; a large dish; and two small saucers (Gardiner 2013:199-202). Again, along with the dovetailed chest, these pewter items suggest a higher status for the onboard medical practitioner.

The cabin and chest also contained a wide variety of ceramic jugs, glass bottles, and canisters made of wood (Appendix I). The ceramic and wooden storage containers that the authors analyzed most likely held medicaments. Seven of the ceramic jars (catalog numbers: 80A1534, 80A1559, 80A1573, 80A1574, 80A1662, 80A1575, and 80A1637) from the chest were identified as Raeren stoneware, produced in the area around Aachen (modern-day Belgium). Of these seven, researchers noted that four of the jars (catalog numbers: 80A1559, 80A1573, 80A1662, 80A1637) retained cork bungs, used to stopper the jars. This detail is important as cork provided a better seal than the wooden bungs of the 15th century (Gardiner 2013:190-192). Another ceramic vessel (catalog number: 80A1459) found was a standing costrel (two-handled jug), identified as Iberian Red Micaceous from Portugal. The contents of the standing costrel were analyzed and identified as *Polypodium vulgare* – Polypody root extract (a form of fern oil) mixed

with milk or animal fat (Gardiner 2013:192). It is described as being "chiefly for melancholy; draws out fleame" (Gardiner 2013:220). A small tin-glazed jug (catalog number: 80A1483) was also found in the cabin. Highly decorated, it "probably used to contain a precious liquid that was needed in small quantities" (Gardiner 2013:192).

The three glass bottles (catalog numbers: 80A1540, 80A1565, and 80A1631) in the medical assemblage of *Mary Rose*, described as pale green in color, small, of similar manufacture, have a "wrythen decoration of slightly protruding spirals running from base to lip…(two) retain their cork bungs but no contents survived" (Gardiner 2013:192-193). As glass is a non-reactive substance, researchers postulate that the bottles stored either volatile/caustic/corrosive liquids used in medical practice, or scented water/oil used as an aftershave. Either of these hypotheses is congruent with a barber-surgeon's kit (Gardiner 2013:192-193).

The next category of containers in this medical assemblage is wooden ointment canisters. A total of nineteen canisters were found, eleven from the chest (Appendix I). Described by the researchers as "similar in appearance with more-or-less straight sides, occasionally slightly barrel-shaped, usually with a somewhat flared, flat base and a lid which may have a raised rim, be flat or slightly domed, that fits over a rebated top" (Gardiner 2013:193). One of the wooden containers (catalog number: 80A1526) is of particular importance as it was found behind the medical chest along with a bone ear scoop (analogous to the modern cotton swab), fleam case, and razor handles. Due to the provenience, the researchers deduced that the medical practitioner or assistant had "recently been shaving, bleeding and/or cleaning the ears of some of the crew, and it is possible that the canister contained something used after shaving" (Gardiner 2013:196).

Other metal items in the assemblage are a cupric (copper-alloy) mortar, a cupric chafing dish, cupric bowl or basin, two cupric syringes, and a pewter syringe. The mortar (catalog number: 80A1672; Appendix I) was found "in the cabin together with a wooden spoon and the handle of another spoon, a bandage roll and a fragment of leather" (Gardiner 2013: 202). The chafing dish (catalog number: 80A1626) was likely part of a charcoal brazier to heat suspension pots and/or cauterizing irons. It has "a series of ventilation holes in the body: eight groups of five small holes arranged in crosses" creating a decorative effect (Gardiner 2013:203-204). Likewise, the cupric bowl or basin (catalog number: 80A1629; Appendix I) may have been used as a suspension pot, as indicated by the blackening to the outside of the object, to heat medicaments such as ointments and plasters or used similarly to a modern frying pan with a single handle (Gardiner 2013:205).

All three of the syringes are complete, though one of the cupric syringes was found outside of the barber-surgeon's cabin (catalog number: 81A5738). It has a shorter and sharper pipe than the others. Of the two found in the cabin, one (catalog number: 80A1560) is made entirely of brass. The body and plunger of the other (catalog number: 80A1741; Appendix I) are made of pewter with a bronze pipe. An associated leather washer was found nearby. The inserted nozzle of each plunger is different in shape; the researchers state that it is unclear whether this "merely denotes different styles of manufacture or relates to the viscosity of the contents" or the orifice used (Gardiner 2013:205).

The chest also contained several wooden spatulas. At least four, found in the chest, of these were used for "mixing ointments, glues, pill masses, etc." with the

fragment of a possible fifth (Gardiner 2013:207). Three other examples have rounded ends; the researchers have not postulated any use for these spatulas (Gardiner 2013:207). These spatulas may also have served to prepare and/or administer medicaments to patients.

Other items are made of wood, leather, textiles, and metal. The wooden objects are a feeding bottle and spoon, mallet, tankards, and treatment or plastering bench. Unlike infant feeding bottles, this type of feeding bottle (catalog number: 80A1555) fed the "very sick and those with facial injuries" (Gardiner: 2005:212). Researchers posit that the bench (catalog number: 80A1503) was used for dressing wounds, including larger limbs and is similar to illustrations found in the "*Lehrbuch* of Hans von Gersdorff of 1517 of the treatment for reduction of a shoulder injury" (Gardiner 2013:214).

Leather objects include a stiffened leather wallet for storing instruments (e.g. fleams, lancets; Appendix I, Figure 29), a small money pouch containing silver coins, and a bottle or costrel used to store clean water or wine (catalog numbers: 80A1564, 80A1584, 80A1693, respectively; Gardiner 2013:214-215). The metal objects include a simple brass whistle (catalog number: 80A1586; Appendix I), as well as numerous tiny mercury globules (no catalog number assigned). The mercury most likely came from one of the containers found in the chest (Gardiner 2013:215). Mercury was a contemporary medicament, widely prescribed as a treatment for ailments such as syphilis and digestive troubles and therefore not unusual to find in a medical practitioner's kit (Clossy 1763:85; Woodall 1617:299). The only textile object found in the kit was a black velvet cap. It is very like the ones worn by contemporary barber-surgeons in artwork and illustrations (Gardiner 2013:215-216).

The vast medical assemblage of *Mary Rose* also includes items used for crew grooming. The medical practitioners during this period were barber-surgeons; part of their health and wellness services included brushing and/or combing hair (including facial hair), shaving, and cleaning out their patients' ears. Crew members participated in these grooming rituals, regardless of status, as these hygiene practices were considered preventative medical care (Gardiner 2013:216-218). The items used for grooming were included in Table 7 in Appendix I, as they were considered contemporary medical instruments. All of objects from the medical assemblage of *Mary Rose* reflect a medical practitioner that was well-versed in contemporary theories and practices.

QAR

Prior to serving a new role as the infamous pirate Edward Teach's (Blackbeard) *Queen Anne's Revenge* (*QAR*), the ship named *La Concorde* was a French slaver that worked off the coast of West Africa. It made the voyage from Nantes to the West Indies, stopping on the Coast of Guinea. These voyages occurred in 1710 – 1711 as a merchant ship, and then in 1713, 1715, and 1717 as a slaver (Ducoin 2006:19-139). Captured on November 28, 1717 off the coast of Martinique the ship's captain, Pierre Dosset, and Lieutenant François Ernaut made the voyage back to France and were deposed in Paris, to give evidence that four men freely gave themselves to the pirates and the pirates took ten men, including the ship's surgeons, carpenters, pilot, second cook, and gunsmith, captive. This information places *La Concorde*'s three surgeons in the service of Blackbeard prior to the wrecking event (Ernaut 1718:2-3).

The *La Concorde*, now renamed *QAR*, made its way up the eastern coast of the American colonies, stopping first in Charleston, South Carolina to replenish medical supplies. Shortly thereafter, the ship headed north where it eventually was lost in 1718 off the coast of modern-day Beaufort, North Carolina (Wilde-Ramsing 2009:123-124, 127, 130-132).

As with most shipwreck assemblages, the wrecking event and subsequent site formation processes have influenced the analysis of these objects. Provenience of objects can provide context for the relationship of objects to one another and the ship, demonstrate site formation processes, and/or archaeologically indicate the nature of the wrecking event. Therefore, the site map was a vital part of the analysis of these objects.

Designated as archaeological site 31CR314 (hereafter referred to as *QAR*) by the North Carolina Department of Natural and Cultural Resources (NCDNCR), the wreck was discovered 21 November 1996 by Intersal, Incorporated (Wilde-Ramsing 2009:7). The company turned the site over to the State of North Carolina, which has since been in charge of archaeological and conservation efforts. Several of the objects recovered from site are associated with onboard medical practitioners. This medical assemblage includes a urethral syringe, the remains of at least two clyster pumps (anal syringe used specifically for enemas), at least two sets of nesting weights, mortar and pestle, pewter porringer (bloodletting basin), as well as eyelets from a pair of scissors, and a ceramic fragment from galley pots that could serve as possible medical containers (UAB Catalog 2015).

The conservators and researchers at the QAR Laboratory in Greenville, North Carolina have completed extensive research into the function of each of the objects found

at the wreck-site (UAB Catalog 2015; Courtney Page 2016, pers. comm.). The laboratory's external sub-contracted researcher, Dr. Linda Carnes-McNaughton, published a work detailing the medical instruments from *QAR*. It is entitled "Mariners' Maladies: Examining Medical Equipage from the *Queen Anne's Revenge* Shipwreck" (Carnes-McNaughton 2016). The article focuses on shipboard medical practices and mortality trends of crew and human cargo during the early 18th century, provides evidence for the capture and use of medical staff onboard *QAR*, and briefly describes objects from the *QAR* medical assemblage (Carnes-McNaughton 2016). This is the first scholarly work published on the sole topic of the medical instruments from *QAR*.

Fragments of potential medical objects along with those that may be multi-function are included in this *QAR* assemblage. These objects were scattered throughout much of the site, and unit number notes each object's provenience. The site plan, object images, and assemblage table are in Appendix II for easy reference. The scatter pattern raises some questions addressed in the analysis chapter of this thesis.

First, found near the southwest end of the wreck (Unit 75), was a complete pewter urethral syringe (QAR0308.001; Appendix II). The identification of the maker's mark places it as trademarked in Paris and the particular angle of the nozzle confirms the urethral use (Carnes-McNaughton 2016). After removal and analysis, the contents of the syringe (QAR0308.002) revealed expected lithic compounds (sand/silt/clay) along with mercury (UAB Catalog 2015). The lithic compounds are likely a result of the site formation processes rather than use as a medicament. However, mercury was a widely prescribed treatment for ailments such as syphilis and digestive troubles (Clossy 1763:85;

Woodall 1617:299). The presence of mercury in the syringe helps confirm its use in a medical capacity.

At least two, possibly four, clyster syringes were found on site. A complete clyster syringe was found in Unit 227. The top of a clyster syringe (QAR1904.000; Appendix II) was found in Unit 130 whereas the bottom of a clyster syringe (QAR2517.000) was found in Unit 166. These two parts may comprise a single syringe or parts of two separate syringes. The body of a clyster syringe (QAR3471.000, Appendix II) was also found nearby. Another pewter fragment (QAR3840.001), believed to be a part of a clyster syringe, was found in the dredge spoil of Unit 268 (UAB Catalog 2015). This may be a part of one of the two other clyster syringe pieces, part of different syringe, or the pewter may belong to something else entirely. The clyster syringe was used to administer enemas, medicaments for those unable to receive medicines orally due to intestinal troubles, and provided a more rapid absorption of medicaments. Samuel Clossy's 1763 treatise *Observation on Some of the Diseases of the Parts of the Human Body* describes the use of laxative clysters as a means to take pressure off of a blocked intestines and allow for uniform movement of blood through the body, thus allowing more traditional treatments to be effective (Clossy 1763:85).

Also found on site was a pewter porringer (QAR2350.000; Appendix II). Flattened, most likely from the site formation processes or wrecking event itself, this porringer may have served as both a food dish as well as a phlebotomy instrument. Similar to other objects found on site, the porringer is marked on the top of one handle with 'I', 'M', and a fleur de lis. According to Phillipe Boucaud, an outside researcher for the QAR Laboratory, the fleur de lis indicates a French manufacturer from the Lorraine

province, and the rope-like motif is associated with pewter objects from the town of Metz (UAB Catalog 2015). Dr. Carnes-McNaughton believes that this instrument served both medical and non-medical functions, including food storage and service, prior to the wrecking event (Linda F. Carnes-McNaughton 2016, elec. comm.).

Medical practitioners used mortars and pestles in the creation of medicaments. A mortar (QAR0714.000, Unit 166; Appendix II) and pestle (QAR2310.000, Unit 156; Appendix II) were both found on site, but not in the same unit. These two units are close enough in proximity that it is possible the two objects belong together and were simply found in different areas due to site formation processes. Both the mortar and pestle are made of a cupric (copper alloy) metal (UAB Catalog 2015). The presence of several sets of weights on site further confirms the pharmaceutical nature of these objects.

Though considered multipurpose in regards to use outside of medical practices, weights allowed medical practitioners to create medicaments according to known recipes and are thus considered pharmaceutical. Nesting weights were especially helpful to shipboard medical practitioners, as space was at a premium onboard. Much like Russian nesting dolls or measuring cups, nesting weights fit inside of each other. A lid with a hinge closure fit over all of the cups, keeping them together (Carnes-McNaughton 2016). Of the eleven nesting weights found on site, two nesting weight set lids (QAR3810.001 and QAR3335.002; Appendix II) were also recovered. Each of the lids was found on different parts of the site, but within proximity of other medical instruments and their presence positively places at least two nesting weight sets onboard prior to the wrecking event (UAB Catalog 2015).

One nesting weight set (QAR2590.001-QAR2590.008; Appendix II) without an accompanying lid was found in a single concretion in Unit 168. This cupric metal set is comprised of six nesting weights, a master cup, and the fragment of a latch. Four of the six weights and the master cup (Appendix II) are imprinted with a fleur de lis; three of the weights and the master cup also have an Arabic numeral (either 1, 2, 4, or 8) imprinted over another fleur de lis (UAB Catalog 2015). The rectangular cartouche of "N dot C" touch-mark on the master cup helped identify the origin of manufacture, Montpelier, France (Carnes-McNaughton 2016).

Five other loose nesting weights of varying sizes were found scattered throughout the rest of the site. All are comprised of cupric metal; however, only one (QAR0473.000) has any distinct markings: a "Y" imprinted on the inside base. The other four nesting weights have no distinguishing marks. A single set hinge (QAR3178.019) found in the dredge spoil of Unit 206 comprises the only other nesting weight associated item in the assemblage (UAB Catalog 2015).

In close proximity to the loose nesting weights, a concretion containing a cast of a pair of scissor handles was found (QAR3291.001, Unit 207; Appendix II). Though the iron leached out through years of exposure to the site conditions, the concretion created a perfect cast of the handles. The eyelets are very round, typical of scissors seen in artwork from this period (Clowes 1637:140-143; Wheeler 2001:27, 54, 135). None of the blade section of the scissors survived thereby prohibiting any sort of analysis of function based on blade length (UAB Catalog 2015). Scissors were used, however, in many areas of shipboard life, including by the medical practitioner. As this concretion was discovered

near other medical instruments, the scissors it contained are included in the *QAR* medical assemblage.

The final object included in the medical assemblage of *QAR* is a ceramic sherd (QAR0418.042) that might have formed part of a galley pot. Found at the intersection of four units (244/245/294/295), it was identified as a body sherd, possibly from the shoulder and/or near the rim of a larger ceramic container (UAB Catalog 2015). These containers would be multi-purpose on a ship and since there is not one particular identifying feature or residue, it cannot be positively placed it within the medical assemblage, nor is there any contra-indication of its use for medical purposes.

As the *QAR* site is still under investigation and only 60% complete, the list of items in the medical assemblage may increase over time. The QAR Laboratory still has a large quantity of objects in concretion, though the majority has undergone X-Radiography and do not appear to hold any other medical instruments. Plans for continued excavation at the site until 2018, however, may produce more artifacts associated with the medical assemblage. Thus, upon completion of the excavation, all objects from the medical assemblage should be reconsidered to create the full picture of the shipboard medical care.

The Mütter Museum

The Mütter Museum, a part of the College of Physicians of Philadelphia, was established in 1858 through a donation of 1,700 medical related objects and $30,000 from Thomas Dent Mütter, M.D. (Jones 2002:1; Worden 2002:9; The Mütter Museum 2016). The donation stipulated that the college “hire a curator, maintain and expand the

collection, fund annual lectures, and erect a fireproof building to house the collection" (The Mütter Museum 2016). Dr. Mütter was interested in advancing medical learning through the system of "teaching medicine based on close observation of actual cases" after having spent an extensive amount of time in Europe learning the latest techniques in plastic and orthopedic surgery (Worden 2002:9).

When it first opened, The Mütter Museum was mostly educational in nature; medical students and professors would come to the Museum to study gross anatomy, learn about historic and contemporary instrumentation, and listen to lectures on new techniques and advances in medicine (Worden 2002:9-10, 14). Today, The Mütter is considered to be one of the finest medical museums in the United States. It houses a large collection of medical-related objects, such as historic medical instruments. Over time, Museum has survived since its mission included the education of the general public (Worden 2002:15).

With its vast medical collection, a selection of items that fit into a mutually agreed upon (between the researcher and Collections Manager George Grigonis) set of parameters was chosen as representative of both the museum (specifically) and land-based practices of the period (generally). Grigonis, along with other collections staff at The Mütter Museum, were able to winnow down the large list of objects to fit a particular time period and reflect the instruments found in the other assemblages. After it was compiled, the researcher further narrowed the list by removing any duplicate objects. The selected assemblage includes instruments common among those found on the archaeological sites considered in this thesis, as well as in the historic documentation (e.g.: John Woodall's *The Surgions Mate*). The selected collection, found in Appendix

III, includes instruments from various donations and acquisitions throughout the Museum's history, and therefore represents a larger temporal spread. These objects range from mid-18th century to late 19th century items. The selected collection reflects a range of medical instruments used in land-based medical practices, including those of greater specialization of functions and use, from the first 150 years of the United States of America's existence.

There are two medical chests in the selected collection of The Mütter Museum. The first (catalog number: 16003.00), owned and used by Benjamin Rush, M.D., from Philadelphia, PA, dates to the 1770s and the contents reflect an internal medicine or pharmacological focus. The chest itself is made of wood with individual compartments to stabilize the 16 stoppered glass bottles of various sizes. A drawer pulls out from the bottom revealing compartments for other medical instruments. Of the bottles in the upper section, five have their original labels (whiskey, brandy, paregoric, calomel, and 'Black Sand from Lake Superior'). Other items in the upper section are a square ceramic pill tile and wood handled spoon, both of which would have been used to create and administer medicaments (The Mütter Museum Catalog 2016).

According to museum records, Ernest Christian Bethansen, M.D. from Hamburg, Germany, owned the second chest (catalog number: 16019.00) and it accompanied him while he worked for the German and Danish governments during the late 18th century. The top opens, along with a hinged front panel. The wooden chest has several compartments, much like the previously described chest, including places for individual glass containers underneath the lid and below the top level. There are seven drawers, each with slips of paper describing the original contents of the drawer. The museum records

state that chemicals are present in the bottles, however no further information regarding the contents is available at this time (The Mütter Museum Catalog 2016).

There are several phlebotomy related items from the selected collection. The two bleeding bowls selected reflect two different material typologies. The first is a copper bleeding bowl (catalog number 1994.5.2; Appendix III) with a large semi-circle cutout area in the rim, while the second is of glazed ceramic (catalog number: MISC-2064; Appendix III) with a painted floral design, is slightly deeper, and has a less pronounced cutout area in the rim from the first (The Mütter Museum Catalog 2016). Both of these bleeding bowls are different from their archaeological counterparts in that the shapes of the bowls reflect the manufacturing of the 19th century. The material typologies, however, are congruent with those found onboard *Mary Rose* even though they were specifically curated.

Two cupping cups (catalog numbers 2015.1.2 and 2015.1.3; Appendix III) circa 1850 were included in the selected collection. Both belonged to William Pinckney Hatchett, M.D. Each of these cups is a horn vessel with a brass stopcock bottom, allowing for adjustments to be made while attached to the patient (The Mütter Museum Catalog 2016). Though different from glass cups, these two cupping cups represent both an advance in the technique as well as a material typology that may not survive a harsh underwater environment.

Three sets of scarifying and cupping instruments (catalog numbers: 17131.16, 17831.15, and MISC-1091) were also included in the selected collection. The first set (catalog number: 17131.16; Appendix III) is housed in a textile-lined wood box with separate compartments for each of the individual instruments. The set includes an eight-

bladed scarificator, syringe, and glass catch-cups. The original owner was Alan J. Smith, M.D. The second set (catalog number: 17831.15; Appendix III) is also housed in a textile-lined wood box with separate compartments for each of the instruments and contains two 12-bladed scarificators, seven cupping glasses, and a spirit lamp. W.E. Chamberlain, M.D, previously owned this set. The next set (catalog number: MISC-1091; Appendix III) is a part of a larger collection originally belonging to Dr. William Pepper. The set contains five cupping glasses with metal attachments, a cupric metal syringe, additional cupric metal screw attachment, all housed in a velvet-lined wooden box with individual compartments for each of the instruments with a locking mechanism (The Mütter Museum Catalog 2016).

The next items from the selected collection are two pewter enema syringes. The first (catalog number: 2002.10.34) is a late 18th century pewter syringe with a wood plunger and was utilized by Dr. Cornman, who specialized in diabetes (Appendix III). The second (catalog number: 17090.90, Appendix III), is listed as an obstetrical enema syringe (The Mütter Museum Catalog 2016). Both saline and soap enemas were adopted as a way to combat the exposure of the infant to fecal matter. This controversial method is not dissimilar to enemas performed to alleviate stomach and bowel troubles of someone suffering from a diet lacking in fresh fruits and vegetables, such as a ship's crew (Clossy 1763:25-26, 85; Cuervo et al 2006).

Four different mortar and pestles were chosen for this assemblage. The first (catalog number: 1506-MISC), is a small wooden mortar and pestle circa 1790 from Austria (Appendix III). Donated by Terry Ann Glauser, M.D., the second (catalog number: E2011.10.1; Appendix III) is very small in comparison to others previously

described (only 2.5cm tall), but is similar in shape and composition to the mortar and pestle found at *QAR*. Both are cupric with very stylized pestles. The third (catalog number: 2011.10.15), also donated by Glauser, is wooden and described as an "old world mortar and pestle." The bulbous shape of the pestle is unique to these four items. The final (catalog number: MISC-1493) is wooden and is of special note as it was manufactured in Concord, Massachusetts and was owned by Dr. Edward B. Krumbhaar (The Mütter Museum Catalog 2016).

Three different types of balances and associated weights were chosen for this assemblage. The first (catalog number: F2011.1) is described as a Henry Troemner double pan balance with a handmade wooden base (Appendix III). There are no weights associated with this object. Placed on a table, this type of balance required no pivot point and could be operated without being held. The second (catalog number: MISC-1099) is a French hand balance with weights (Appendix III). The researchers determined the French manufacture based upon the square shape of the weights and the inscription of the place of manufacture. The catalog description states: "[t]he year of issue was inscribed, and letters of the alphabet were stamped on the weights to indicate the city in which they were made" and the letter 'A' denotes that the set was manufactured in Paris during the late 18th or early 19th century (The Mütter Museum Catalog 2016). The cupric set is contained in a wooden box with special compartments for each of the components. The third (catalog number: 16010.02) is a set of cupric apothecary scales with a steel crossbar, lead weights, small ceramic dish and steel spatula for measuring out chemicals (Appendix III). All of the objects fit in a small mahogany box (The Mütter Museum

Catalog 2016). This type of scale was hung from a pivot point to provide the correct balance.

Several cutting instruments were chosen for this collection, including surgical kits or sets. A single pair of steel scissors (catalog number: 1988.16.98) from the 19th century was included in the selected collection (Appendix III). The blades are short (3cm) and slightly angled for easier cutting of tissue during surgery. The handles are twice the length of the blades (6cm) and the oval eyelets reflect the change in scissors. The provenance of these steel scissors is from Myer Solis-Cohen, M.D. Next is an amputation saw (catalog number: 2000.6.5) made of steel and ivory. The smooth, un-carved ivory handle has yellowed on one side due to age, exposure to natural oils, and the placement of the instrument on a non-colorfast textile (The Mütter Museum Catalog 2016).

A small surgical instrument set (catalog number: 16500.08.6) is contained in a wooden box (Appendix III, Figure 64). The set includes a pair of scissors, hemostat clamps, forceps, and probes. Another surgical kit (catalog number: 16500.08.4) is described as one for field hospital surgery. Included in the wooden box are steel amputation saws, surgical knives, trepanation tools, and a tourniquet. The kit contains a maker's mark from Henry Schively of Philadelphia, Pennsylvania. A third surgical set (catalog number: 17823.87) included in the collection dates to the 1860s, was originally the property of the U.S.A. Hospital Department and was used by the U.S. Army (Appendix III). It is a regulation *exsecting* (amputation and surgery) set that includes large bone-cutting forceps, sequestrum forceps, two gnawing forceps, chassaignac-ecraseur (obstetric surgery), chain saw, lenticular, straight edge chisel, and bone gouge.

Missing items are listed as retractors, trepan, and a gutta-percha pouch (The Mütter Museum Catalog 2016).

Summary

The objects in the selected collection from The Mütter Museum reflect various land-based practices from internal medicine to obstetrics. Despite the differences in date of use and accounting for stylistic changes, each of these objects is similar in typology (phlebotomy, pharmaceutical, multipurpose, etc.) to those found in the medical assemblages of the two shipwrecks previously discussed. Further analysis is required to understand the relationship between shipboard and land-based medical practices during the time period of both the shipwrecks previously discussed, and those from The Mütter Museum, which is discussed in detail during the final chapter of this thesis.

Prior to undertaking any comparative analyses, it is essential to understand the history surrounding and learn about individual objects within the assemblage. In-depth case studies fulfill both requirements. By understanding the temporal and spatial differences between the three assemblages studied here, it becomes possible to create both individual and comparative analyses.

Chapter 6: Analysis and Conclusion

Comparative analyses of assemblages provide researchers with the unique opportunity to posit overarching question and look for trends in different cultures and/or time periods. By examining a specific set of objects researchers can find trends or disparities fitting their questions; these may lead to discoveries regarding the particular culture and/or time period in which they are working or lead them in a new and different direction for further research. The following sections outline both individual and comparative analyses of all three assemblages researched for this thesis.

Individual Analyses

Before analyzing the three assemblages in a comparative manner, each assemblage must first be tackled individually. This section will break each assemblage down statistically to determine the significance of the different material typologies within each of the collections. Provenience and site formation processes provide insight into the analysis of the two archaeological assemblages. Similarly, provenance and known histories of objects from the museum collection will also factor into the analysis.

Using Stanley South's (1978a, 1978b, 1979) method of pattern recognition, a table was created with all available information from each of the assemblages. An historically likely category of use during the objects' use-life (medical care specialties and sub-specialties) was assigned to each object as a means of understanding the statistical significance of objects within the assemblage. Each category was then counted

for each individual assemblage and the data was compiled into a master assemblage table. This statistical approach was necessary to facilitate a comparative analysis.

Mary Rose

The first medical assemblage considered is that of *Mary Rose*; with 112 objects, it is the largest of the three assemblages analyzed (Appendix I, Table 7). The historical and archaeological evidence gleaned from *Mary Rose* indicate that a barber-surgeon, and possibly an assistant, onboard the ship prior to the wrecking event. The large quantity of objects reflects several things that impact this analysis: first, the ship's complement was likely much larger than that of *QAR*. *Mary Rose* was a naval vessel serving during the early English naval domination while *QAR* was a merchant slaver turned pirate vessel (Marsden 2003:7-8, 10-17; Ducoin 2006). Differences in ship construction and maneuverability between *Mary Rose* and *QAR* also account for the disparity in number of crew between the two ships.

Second, the large assemblage may reflect the experience of the medical practitioner. Of the officers reported to have served onboard, only one, Rob. Smyson in July 1513, is listed as a surgeon (Marsden 2003:9). Though it is possible there were other surgeons who practiced onboard *Mary Rose* prior to the wrecking event, no other published records have thus come to light to substantiate this supposition.

If Rob Smyson, however, served as the only surgeon onboard from 1513 until the wrecking event in 1545, he would likely have encountered a wide variety of ailments and maladies in his long career. Residue analysis performed by researchers at The Mary Rose Trust supports this theory. Of the 48 containers found among the artifact assemblage, at

least 38 can be identified as pharmaceutical in nature, and another 9 that may have contained medicaments at one time or another (Gardiner 2013:193-200, 219-225). The wide variety of instruments, both specialty and multipurpose, might also highlight the practitioners' medical training, contemporary medical practices, and practical onboard experience.

Finally, the large quantity of medical instruments may simply reflect the wrecking and site formation processes. It is possible that approximately 100 objects was the contemporary 'average size' of a practitioner's kit and that the relative minimal disturbance to the site and underwater conditions may have played a role in the high object count. Though it is plausible the site formation process played a role in the high object count, it is hard to discount the evidence of a well-seasoned, veteran barber-surgeon onboard.

The next aspect to examine is the individual typology categories, both general and specific. These two categories provide an outlook as to what the medical practitioner treated and/or expected to treat onboard. First, the general typologies provide an overview of the types of objects the medical practitioner carried with them (Table 2).

TABLE 2. GENERAL TYPOLOGIES OF *MARY ROSE*

Object Type (General)	**Count**
Pharmaceutical	47
Multipurpose	31
Miscellaneous	14
Recovery	8
Grooming	7

Amputation	3
Phlebotomy	2
Total	112

From *Mary Rose,* the largest category is Pharmaceutical – objects that were used to store or create medicaments. Chemical residue analysis confirms the presence of known contemporary medicaments on many of these objects (Gardiner 2013:219-225). The other pharmaceutical objects were placed in this category through historical research into the nature of the use of these objects.

The second largest category from *Mary Rose* is Multipurpose which is comprised of objects that could serve in multiple categories, such as blades (amputations, bloodletting, and grooming), bowls (bloodletting, medicaments storage), and the medical chest that contained objects from multiple categories. Space on a ship was at a premium, and multipurpose objects provide maximum impact with minimum spatial impact.

Two of the categories, Recovery and Grooming, contain eight and seven objects, respectively. Both categories fully reflect the tasks appointed to the barber-surgeon onboard *Mary Rose*. Recovery items, such as the bandage rolls and feeding bottle directly demonstrate that patient care was indeed a part of the barber-surgeon's practice. The Grooming objects reflect the barbering aspect of the practitioner's job since the health and welfare of ship's crews during this time period included regular barbering and grooming of hair, facial hair, and ears.

The two categories with the least number of objects, Amputation and Phlebotomy, do not necessarily reflect that these two specialties were performed on an irregular basis. Rather, it denotes that these single function objects could be positively identified as

belonging to one of these two categories. Items such as the leather wallet, fleam case, and saw handle are easily identified as such. The fleam case and leather wallet most likely held razors to perform phlebotomy whereas the saw handle most likely provided grip during amputations. Other objects that fall into the multipurpose category, such as the porringer, may have been used during amputation or phlebotomy procedures, as well as for others such as grooming or creating medicaments.

The final category for the *Mary Rose* medical assemblage analysis is Miscellaneous. The various items in this category range from personal clothing of the barber-surgeon to a bench that could have been for personal and/or professional use. Creating individual categories for each of these objects would not have been helpful for this particular analysis, but may prove to be of use to another researcher.

Each of the objects was also given a specific typology, and this statistical analysis can be seen on Table 3. The two largest categories, Container and Instrument, are unsurprising since they are the most general of the specific categories. The barber-surgeon had a large quantity of canisters, bottles, and jugs that could have held medicaments, and an array of handles that originally held a large assortment of instruments.

TABLE 3. SPECIFIC TYPOLOGIES OF *MARY ROSE*

Object Type (Specific)	**Count**
Container	48
Instrument	37
General	6
Dressing	6

Personal Care	5
Barbering	2
Case	2
Clothing	2
Medicaments	1
Set	1
Total	112

The Dressing and Barbering categories are fascinating and unique to this assemblage. The prepared linen bandage rolls all fall into the Dressing category, as well as the larger category of Recovery. Neither the Dressing nor Recovery category is seen in either of the other two assemblages analyzed for this thesis. In the case of *QAR*, this may reflect that qualifying objects either were never onboard or did not survive the site formation processes. The assemblage from The Mütter Museum, however, is another matter. These are the types of items that would have been discarded after use (much like a self-adhering bandage strip) and not survive or were not considered significant enough (either by donors or the institution) to include in acquisitions. The Barbering category of the *Mary* Rose directly reflects the wider role of the barber-surgeon as an onboard medical practitioner. However, three centuries of strained relations between barbers and surgeons eventually "came to a head in 1684, when the [English] surgeons petitioned Charles II" stating that barbers were "'altogether ignorant of the Science or Facultie of Surgery…'" (Fu 2000:37). By the time of the wrecking of *QAR* and the initial intake of donations to The Mütter Museum, barbering was no longer a major part of the medical practitioner's practice.

The categories Case and Set both reflect similar typologies. The set of objects is the actual medical chest from *Mary Rose*, which could also be considered a case. However, it was determined that since it was recovered from site with other objects inside, it should be considered in the Set category. The two objects in the Case category also fall into the larger Phlebotomy category and were previously discussed.

Items in the General category, such as silver coins and the whetstone, may either be personal items or those used to care for other instruments or patients. The mercury globules found in the medical chest were categorized as Medicaments, as they fit no other specific category. The objects in the Clothing and Personal Care categories reflect the medical practitioner's personal wardrobe and grooming objects that could be used either on the barber-surgeon himself or as a part of his practice. Again, these reflect the differing nature and status of the barber-surgeon of the 16th century to the medical practitioners of the 18th century.

QAR

The medical assemblage from *QAR* by comparison is much smaller (see Appendix II). With only 28 objects, only a very limited picture regarding onboard medical care can be presented. The limited number of objects may reflect the site formation processes. The site is located in a very active inlet that is affected by both natural and cultural forces. The scatter pattern of objects around the site may provide clues as to the small quantity of objects in the medical assemblage. Smaller and/or lighter objects may have scattered further away from the ship during the wrecking process, thus having no real context, have become completely separated from the ship and lost to the

ocean, or became so degraded over time that no identifiable object remained. Again, these objects were placed in both general and specific material typologies; however, the limited number of objects, reduced the number of categories in each.

First, the three general categories are Pharmaceutical, Multipurpose, and Phlebotomy. As seen in Table 4, the majority of objects are pharmaceutical in nature. There are a few explanations for this: first, as seen on *Mary Rose*, the pharmaceutical objects may have indeed comprised the largest number of objects in the medical practitioners' full set of objects prior to the wrecking event. That the archaeological remains comprises the largest category now is a direct reflection of the original statistic.

TABLE 4. GENERAL TYPOLOGIES OF *QAR*

Object Type (General)	**Count**
Pharmaceutical	21
Multipurpose	6
Phlebotomy	1
Total	28

Second, the majority of the pharmaceutical objects are cupric nesting weights, though the weights may also be considered multipurpose as they could have been used by others onboard in a non-medical fashion. However, for the purposes of this discussion, the weights were placed in the Pharmaceutical category. As nesting weights are heavy objects, they were able to withstand the extremely active nature of the site and were not scattered or lost, as would have items made of other materials. Third, if historical accounts are included, a large chest of medical supplies (specifically medicaments) was obtained in Charleston in the months prior to the wrecking event (Wilde-Ramsing

2009:127). Thus, the ship's medicaments stores were replenished and would have statistically comprised a larger portion of the medical practitioner's supplies.

The Multipurpose objects found in the *QAR* medical assemblage include the syringes and scissors. Though each have specific uses, the syringes and scissors could have both medical and non-medical functions. For the purposes of this thesis and the comparative analysis section that follows, it was important to view these objects in broad terms. The syringe analyzed by the researchers at the QAR Laboratory was determined to be urethral in nature (Linda F. Carnes-McNaughton, elec. comm.; UAB Catalog 2015). The contents of the syringe included lithics (sand/silt/clay) from the wreck site and mercury. As previously mentioned, mercury was an essential part of historical treatments of diseases such as syphilis, and may help determine the types of diseases and treatments administered on the ship prior to the wrecking event. All that remains of the scissors are a cast of the handles; they are consistent with the shape and size of surgical scissors but may also represent scissors used by crew repairing sails. As the blades of the scissors were not a part of the original concretion, it is unlikely that they will be found at a later date. Thus, the original function(s) of the scissors are likely to remain unknown.

The final category is Phlebotomy, and the only object that falls into that category is a porringer. Again, this object could have been categorized as multipurpose in that it was likely used in both a medical and non-medical context (Linda F. Carnes-McNaughton 2016, elec. comm.). However, if only a medical context is considered for the functionality of the porringer, it is possible that it was used to create medicaments. It was, however, most likely used as a bleeding bowl. Similar porringers used as bleeding

bowls were previously discussed in the history section of this paper (Thompson 1954:490).

Of the specific material typologies, there are only two categories: Instrument and Container, as seen in Table 5. As the assemblage is much smaller than that of *Mary Rose*, it is unsurprising that all of the objects could be placed into one of these two large categories.

TABLE 5 SPECIFIC TYPOLOGIES OF *QAR*

Object Type (Specific)	**Count**
Instrument	26
Container	2
Total	28

First, the category Instrument describes all but two of the objects in the *QAR* assemblage. These objects can best be described as able to function specifically as a medical instrument, even if able to function in another capacity (multipurpose), such as the scissors. Objects such as the mortar and pestle also fall into this category. The second category, Container, includes two objects – the ceramic vessel sherd and the porringer. Though the porringer might also be thought of as functioning as a specific instrument (i.e. for blood catching), it can best be described as a medical container. However, the ceramic vessel sherd only functioned as a container, probably for medicaments.

Overall, the small assemblage size makes it difficult to determine the level of medical care provided onboard. As previously mentioned, there were at least two sets of nesting weights onboard prior to the wrecking event. This suggests either that there were multiple medical practitioners onboard or the medical chest(s) onboard contained multiple sets of nesting weights. The first hypothesis supports the historical evidence of

QAR, in that as *La Concorde*, there were three medical practitioners onboard who likely each had their own set of instruments (Ernaut 1718:2-3; Ducoin 2006:90-92). The second hypothesis supports the idea of medical chests being something like a modern physician's kit, containing a semi-standard number and type of objects. If more than one of these types of medical chests was onboard at the time of wrecking, it is plausible that multiple instruments (such as the nesting weights) were also onboard, regardless of the number of medical practitioners.

The Mütter Museum

The assemblage from The Mütter Museum differs significantly from the previous two assemblages discussed. First, it is a museum based collection rather than an archaeological or site-based collection; and second, the assemblage was curated and winnowed down from a much larger overall medical collection. The chosen objects represent certain suggested parameters so that the assemblage would more closely reflect the types of objects available during this time period, and this selective process does skew quantitative results. However, the selected assemblage resembles the two analyzed archaeological assemblages in that it is an incomplete look at a single medical practitioner. The objects from *Mary Rose* reflect the most complete assemblage by far, but without historical documentation of the specific instruments in their kit, it is difficult to determine if the *Mary Rose* assemblage is fully complete. Without a single-source and complete medical assemblage, it is difficult to determine the extent of completeness of the selected Museum collection (Appendix III).

The assemblage was sorted into both general and specific material typologies. The general material typology breakdown can be seen on Table 6. The four general categories are as follows: Multipurpose, Phlebotomy, Pharmaceutical, and Amputation. First, the majority of objects in the assemblage were considered Multipurpose objects since they could medically serve in more than one capacity. Half of these were a part of a set or kit that contained several different objects, thereby relegating the objects to the Multipurpose category. The other five objects were considered instruments and will be further discussed later in this section.

TABLE 6. GENERAL TYPOLOGIES OF THE MÜTTER MUSEUM

Object Type (General)	**Count**
Multipurpose	10
Phlebotomy	9
Pharmaceutical	7
Amputation	2
Total	28

The second category, Phlebotomy, contains instruments that were used in bloodletting and contain five cupping sets, two individual cupping cups, and two bleeding bowls. The high number of these objects reflects the priority placed on bleeding and cupping practices during this time period (Weinberg 1994:132; Whitaker et al 2004:135-136).

The third category, Pharmaceutical, contains four different mortar and pestle pairs and three different types of apothecary scales. Each of these instruments was a key part of the preparation of medicaments and would have been a necessary part of the medical practitioner's kit. The different scales types represent not only the variety but also the

accessibility and availability of alternate objects to land-based medical practitioners from 1770-1890.

Finally, two objects comprise the Amputation category: a bone saw and an amputation set. These single purpose objects demonstrate not only the necessity of having the correct tool for the job, but also that these tools must be kept together in an easily accessible place.

Of the specific material typologies, the Museum collection was divided into three categories: Instrument, Set, and Container (Table 7). Again, it is unsurprising that the specific categories were few in number, as the selected assemblage was only comprised of 28 object records. If, however, The Mütter Museum had broken down the object records more specifically and recorded each of the objects in the sets and chests individually, not only would the overall assemblage count increase, but there would be a corresponding increase in the general and specific material typologies.

The first specific material typology is Instrument, which is the largest of the three categories (Table 7). It includes objects from the four general typology categories, as expected. Specific medical instruments comprise the majority of the category, from both general and specialty medical practitioners such as Internal Medicine and Obstetrics respectively.

TABLE 7. SPECIFIC TYPOLOGIES OF THE MÜTTER MUSEUM

Object Type (Specific)	**Count**
Instrument	14
Set	12

Container	2
Total	28

The second category, Set, describes instruments that were placed together due to their close association either in function or original intended use such as an amputation set or general medical chest. These sets generally came with or in a purpose-built case, with individual compartments for different objects, occasionally lined with precious fabrics such as velvet to protect fragile objects (such as cupping glasses) during frequent movement.

Container, the third category, surprisingly only includes two items: one copper and one ceramic porringer (bleeding bowl). As previously stated, these two objects might also be considered in the Instrument category, as they are specific to the function that they serve. The primary functions of these objects, however, were the collection and containment of blood, and were therefore placed in the Container category.

Comparative Analyses

Prior to discussing the comparative analyses, it is imperative to mention a few observations. First, both of the archaeological assemblages come from two different types of vessels that likely had two very different sets of people onboard. As a naval vessel, researchers expected and found that 100% of the osteological analysis performed on the skeletal remains of *Mary Rose* fell into either "male" or "likely male" categories (Gardiner:519). Skeletal remains have yet to be found at the *QAR* site. As a slaving turned pirate vessel, it would not be unusual to find some evidence of females onboard *QAR*, including specialized (gynecological) surgical instruments.

Second, both of these assemblages differ from that of The Mütter Museum in that they are from a single source: an archaeological site. Though the Museum began with the collection of Dr. Mütter, through the years the collection grew to include objects from multiple sources. This is not uncommon for collecting institutions. However, dealing with a multi-source collection requires understanding that there will be intrinsic differences between it and any single-source collection.

Thirdly, as a land-based collection, the objects from The Mütter Museum include those used to treat women. As previously mentioned, there is no skeletal evidence of females onboard *Mary Rose* prior to the wrecking event; and there is no evidence of females onboard *QAR* during or just prior to the wrecking event, though females were most likely onboard the vessel at some point.

Lastly, the temporal span of the assemblages from prior to and post medical enlightenment likely causes some of the differences in the instruments found across all three assemblages. Rapid changes in medical theory, knowledge, and practical application are physically represented in the surgical instruments. The comparative analysis was completed keeping these four observations in mind.

To easily compare objects and create a statistical picture, all of the assemblage data was merged into one large dataset. As there were a wide variety of items, each of the two object typology categories were then counted and pie graphs created to better visualize the data.

First, an examination of all assemblages by general type overwhelmingly shows that pharmaceutical items are the largest grouping of items, as seen in Figure 7. The creation of medicaments required a large number of objects such as weights and scales to properly measure out ingredients, containers to store both individual ingredients and mixed compounds, and mortars and pestles to grind the ingredients. Many of the other objects in the overall assemblage group were considered multipurpose in nature and were categorized thus. These included objects such as bladed instruments and syringes that may have a specific purpose and could serve in at least two different medical circumstances.

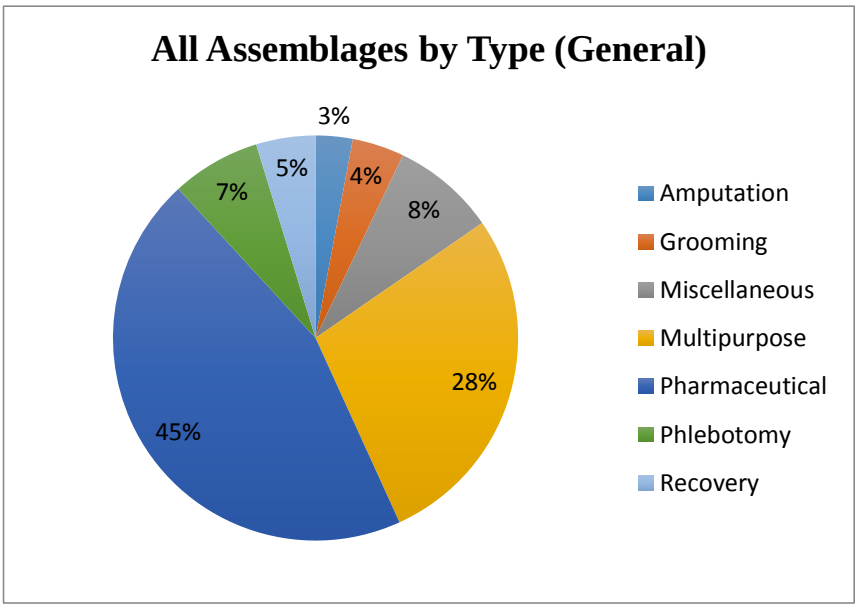

FIGURE 6. Chart of all medical assemblages sorted into general typologies. (Chart by author, 2016.)

The large numbers of miscellany and phlebotomy objects from the Mary Rose and The Mütter Museum assemblages influences the Miscellaneous and Phlebotomy categories, respectively. If the miscellaneous objects from *Mary Rose* were re-categorized, the chart would add three objects to Pharmaceutical, six to Multipurpose, and create a new category, Personal, with five objects (Figure 8). This may better reflect the overall assemblages and delineate the discovered personal effects of the barber-surgeon onboard *Mary Rose* at the time of the wrecking event. Again, taking the collection/donation variables into consideration, the large number of phlebotomy objects from The Mütter Museum can be explained.

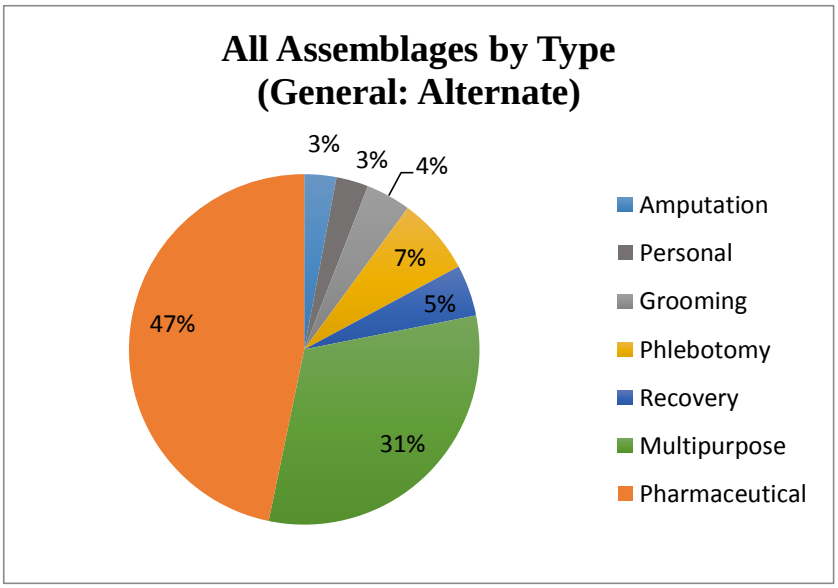

FIGURE 7. Chart of all medical assemblages sorted into alternate version of general typologies. (Chart by author, 2016.)

Working from Figure 8, the second largest category is Multipurpose. Again, this may simply be due to the nature of medicine during this time period. Medical practitioners, both on land and at sea, considered space to be at a premium whether objects remained in a single area or were ported from place to place. Objects that could serve multiple purposes may have survived the record simply because more of them were

collected, and therefore made up a larger percentage of the medical practitioner's individual collection; or the objects were made of sturdier materials, such as pewter and copper alloys, that were better able to withstand the underwater or other uncontrolled environment.

The large percentage of phlebotomy objects speaks to the time period from when these assemblages originate. The equipment used in phlebotomy today is a far cry from the phlebotomy objects in this larger collection. This category is comprised of a mixture of physical material typologies – from sturdy metals to fragile glass and ceramic. It is not surprising that no cupping glasses of either glass or organic material survived the *QAR* wreck site due to its active depositional environment. However, the presence of a porringer at both *QAR* and *Mary Rose* is in line with the type of phlebotomy practiced during this time period which involved creating a small incision in the arm near the elbow or wrist and allowing the limb to rest over the lip of the porringer while blood flowed freely into the basin (Clossy 1763:108-109; Wheeler 2001:122-125).

The objects in the Recovery, Personal, Grooming categories will not be discussed here, as all of these objects are from *Mary Rose* and were addressed in the individual analysis. Therefore, the last category to discuss is Amputation. Both the *Mary Rose* and The Mütter Museum assemblages had at least one instrument that could be associated with amputation. These single function objects most likely were paired up with other objects in each of the assemblages, such as knives, razors, or scissors, which were previously described as Multipurpose and could be used in general surgery. It is probable that the medical assemblage of *QAR* at one time included amputation-associated instruments prior to the wrecking event. Though the absence of these objects is not

unusual due to the nature of the site, it is conspicuous as amputation was a part of life onboard a ship (Woodall 1617:171-177; Mountaine 1761:66; Lavery 1998:500).

An examination of the large dataset by specific material typology is even more revealing on the types of objects that survived the archaeological record as well as the collection/donation variables, as seen in Figure 9. As in the individual analyses, the categories Instrument and Container comprise the largest category. Again, this may simply demonstrate the nature of medical objects or medical practice in general. These two larger categories are expected, given that they were so large in each of the individual assemblage analyses. The next category, Set, is mostly comprised of objects from The Mütter Museum collection; 11 of the 12 objects are from that collection. The other object is the medical chest from *Mary Rose* that contained many of the other objects in its assemblage.

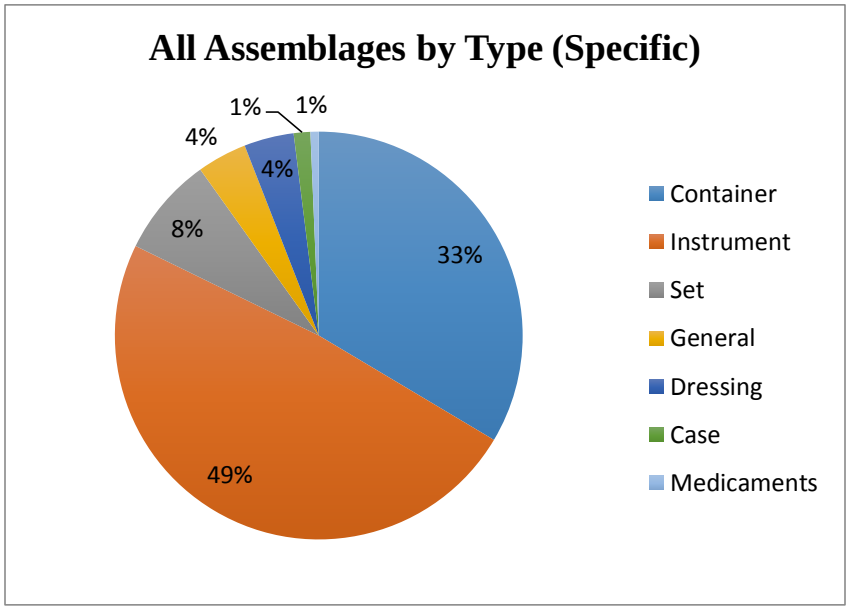

FIGURE 8. Chart of all medical assemblages sorted into specific typologies. (Chart by author, 2016.)

All of the remaining categories are specific categories pertaining solely to the assemblage from *Mary Rose* and were previously discussed in the individual analysis. It is unfortunate that more of the objects from the other two assemblages did not also fit into these categories. Again, this may simply be due to the dynamic nature of the wrecksite and activity of *QAR* or the collection/donation variables of The Mütter Museum. If repeated, this analysis would include a much larger cross-section of objects from The Mütter Museum, as well as include other archaeological assemblages originally intended for this thesis such as the Swedish naval vessel *Kronan* (1676).

Historical Comparative Analysis

The medical assemblage from *Mary Rose* (1545) greatly resembles the information on instruments in the historic texts of Clowes (1637) and Woodall (1617). There are three possible explanations. First, the texts are temporally more closely related to *Mary Rose* and would therefore be influenced by 'average' kits of the 16th and early 17th centuries. Second, the incomplete nature of the medical assemblage from *QAR* prevents it from making a full comparison to these lists. If more medical related objects are found onsite, this historical comparison between *QAR* and these texts should be revisited. And last, as *Mary Rose* is the largest single-source medical assemblage of the three studied, it is statistically more likely to include the items listed in the historic texts.

Conclusion

Taking all of this information into consideration, answers to the primary and secondary questions posed by this thesis begin to form a certain picture. Firstly, the

shipboard medical practitioners' kits reflected the contemporary knowledge and requirements of their position. Consider the grooming instruments from *Mary Rose* and the absence of such instruments in both the *QAR* and The Mütter Museum collections. These objects, or lack thereof, speak directly to the responsibilities of the medical practitioners and how they changed over time. Again, these may be a reflection of land-based practices, but at the very least, a ship's crew most likely received care comparable to what they would receive from a land-based practitioner.

When objects such as the apothecary weights are considered, however, there is a clear difference. Land-based medical practitioners would treat a variety of patients, male and female, from the newly born to those on their deathbed. This is not to say shipboard medical practitioners did not treat female or newborn patients while underway. Physicians aboard a slave vessel would have seen such patients (Archives Départmentales 1711; Sheridan 1981:604, 609, 621; Sheridan 1985:222-224). However, the apothecary weights provide a clue. The assemblage from The Mütter Museum does not contain any nesting weights, whereas the *QAR* assemblage has one full set of nesting weights with several others mismatched. The answer as to the difference between these assemblages lies in a matter of space and time. Land-based medical practitioners would have had an office or building to store all of their instruments and cases, whereas space was at a premium onboard a ship. The shipboard medical practitioners would find nesting weights far more practical in this aspect. Moreover, by the time of the first donation to The Mütter Museum, an entirely different calibration and system of weights was in place.

The second of the two primary questions regarding what the medical assemblages reveal regarding the treatment of medical ailments and health practices aboard ships can

be answered by examining the residues of the medicaments brought onboard both *QAR* and *Mary Rose*. Though it was a standard treatment, the evidence of mercury in medical context at both sites suggests that medical practitioners understood what maladies the crew might encounter. This may or may not have been fully in line with the objects that they were required to carry/were provided by governmental or commercial entities. Perhaps the medical practitioners were simply following a variation of the Hippocratic Oath to do no harm by educating themselves to regular perils at sea and placing forethought into their medical provisions and instruments.

After the analysis, the secondary questions of this thesis are still difficult to answer. As to whether the *QAR* assemblage specifically reflects the skills and practices of the historic documentation, the limited size and variation of the assemblage prevents any determination from being made. Unfortunately, until more objects become a part of the *QAR*'s medical assemblage, this question remains.

As to how the land-based and ship-based assemblages compare, it would be more easily answered within the realm of perfect datasets. As these were not available for research (and likely do not exist), the data available indicates that the assemblages were comparable in that each set demonstrated the medical practitioner's knowledge or anticipation of various maladies they would encounter during their various years of medical practice.

It would be interesting to broaden this study to include medical assemblages from other shipwrecks that are less disturbed, such as *Kronan* (1676). Such assemblages might provide a more complete picture of the thought process of medical provisioning for each of the individual medical practitioners, trends for practitioners from certain sectors

(governmental, commercial, etc.), practitioners who received medical training from specific areas, or temporal trends.

The major focus on research in archaeology for most of the 20th century was simply finding a site and performing Phase I, II, or III investigations. Objects from these archaeological excavations are often sent to various collecting institutions and may or may not receive additional attention from the initial investigator(s). Occasionally, the objects are left in the collecting institution in perpetuity without any second thought about additional information that might be revealed about the site from which they were recovered.

Though now common to terrestrial archaeological studies, maritime archaeology has experienced a more recent shift in focus from site-based to artifact collections-based research. For example, graduate students such as Nathaniel Howe, Stephanie Gandulla, and John Ratcliffe at East Carolina University are including archaeological assemblages as a larger part of or indeed their entire theses. Methods taught by different archaeological institutions now include a focus on researching assemblages from a site worked by the student, objects found in their or neighboring institutions, or objects that fit their overall research goals. The advent of high-speed communications allows for global archaeological community interaction and access to information from various institutions. Researchers are now able to access objects and communicate with other individuals who share similar interests around the world with the touch of a button.

Some restrictions still remain, such as the unwillingness on the part of individuals or institutions to release information to outsiders, restricted access to internal literature by government or private agencies, and the slow pace in which assemblages are processed

and made available for outside researchers. Collecting institutions often have more material than they have staff or funding, and finding outside donors willing to contribute financial resources towards object maintenance and research is far more difficult than finding those willing to donate to a lucrative or well-publicized excavation. It is an unfortunate reality that archaeological researchers face at one point or another during their careers.

As a result of these conditions, students and professional archaeologists alike must continue to push for research opportunities within their own and other collecting institutions. The importance of education pertaining to object care and how to perform assemblage analyses should not be undervalued and should continue to be a part of their theoretical and methodology courses, as well as encouraging the inclusion of object analyses as a part of published works. In addition to the specific research done for this thesis, this analysis is a reflection of coursework, conferences, lectures, and real-world institutional experience with object research.

Museum records of most collecting institutions are, unfortunately, often entered in such a way that they take up a minimal amount of data space on a server. Descriptions in the object records can be helpful for these types of intense breakdowns, but not all object records are entered by the same person and/or in the same amount of detail each time. This is simply a by-product of the museum environment that must be taken into account. Other archaeological master's theses, including those from East Carolina University, have devoted entire sections to Collections Management issues in museums. John Ratcliffe explored the management and storage of wooden casks from *Vasa,* detailing the

struggles all too common to researchers working with museum collections (Ratcliffe 2012:38-44).

The specific categories reflect the types of objects collected by The Mütter Museum, which may be influenced by outside factors (or collection/donation variables). First, if the institution has a mission or has identified a need to collect a specific type of instrument (such as, they have a relatively low number of representative objects) they may begin to focus their collection efforts on a specific typology. Second, donors to the institution may only donate objects that they place importance upon, whether or not the institution itself would consider the objects important. Donors might unknowingly hold objects back from donation because they do not believe they would have any value to the institution. Third, the donors may not donate all of the related objects for sentimental or emotional reasons. And finally, it may be outside the museum's financial ability to take on certain objects or object typologies (i.e. budgetary constraints, lack of storage space or staff, amount of conservation work required for stability). Therefore, museum assemblages should be examined as an open-ended collection rather than a complete or final collection.

To further facilitate comparisons between medical assemblages, a readily accessible database could be created so that researchers can easily draw information from other sites and use that information to form new analyses. Unfortunately, this is unlikely to come to fruition due to copyright and data-sharing concerns by researchers and institutions. Perhaps compilations and analyses such as this thesis will continue to advance the cause of the need for better data-sharing methods amongst researchers.

Other areas of continuing research into shipboard medicine might include the medical treatment of pirates, the care provided to crewmembers who have suffered corporal punishment and the general trends of diseases onboard ships both globally and area specific such as tropical or venereal diseases (Carnes-McNaughton 2016).

Comparative analyses, such as this thesis, provide an opportunity for researchers to examine objects and datasets through different lenses. By understanding other assemblages (or similar data), a clearer picture of the original dataset is available. These analyses are an important part of moving forward with archaeological assemblage research and material culture theory and methodology.

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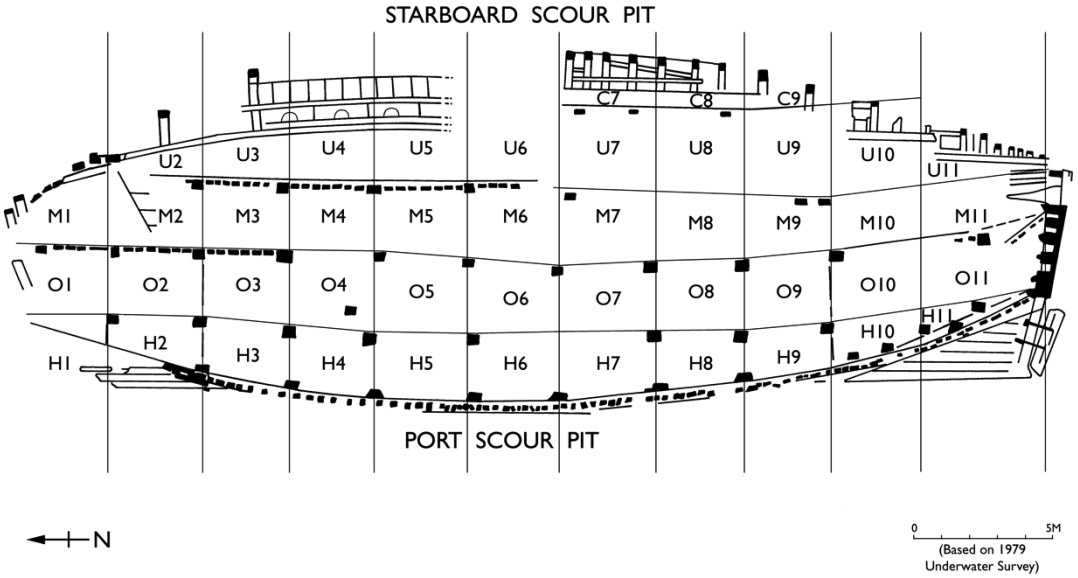
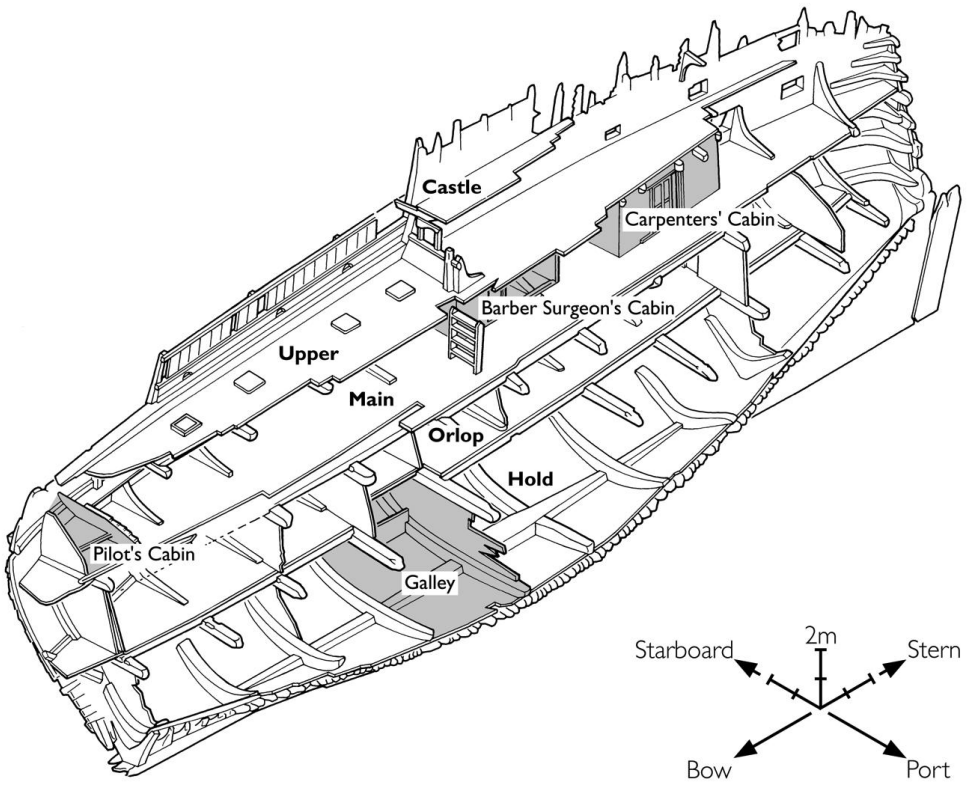
Appendix I: Comparative Data Recovered From *Mary Rose*



Mary Rose site plan: starboard scour pit. (©Mary Rose Trust, Portsmouth, UK.)



Mary Rose site plan: decks and cabins. (©Mary Rose Trust, Portsmouth, UK.)

Barber-surgeon's chest and contents. (©Mary Rose Trust, Portsmouth, UK.)

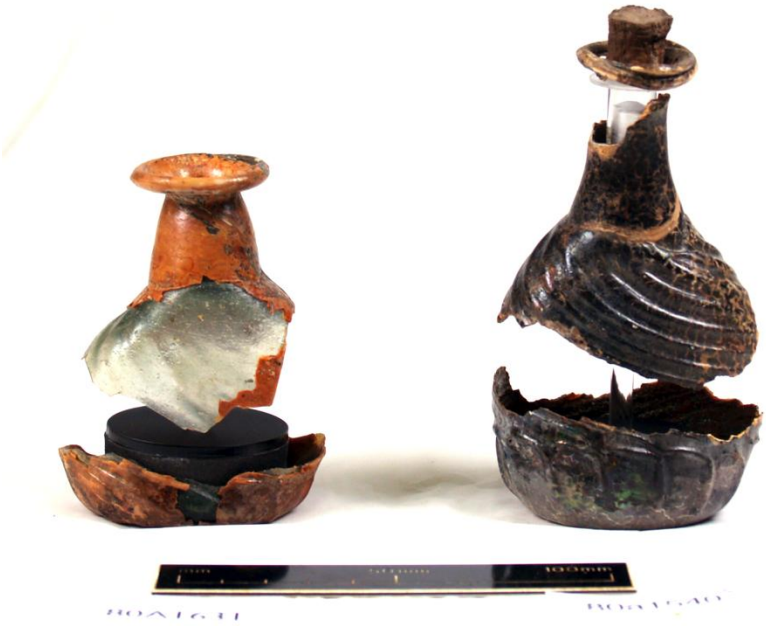
Pewter canisters, syringe, and whistle. (©Mary Rose Trust, Portsmouth, UK.)

Pewter porringer and shaving bowl. (©Mary Rose Trust, Portsmouth, UK.)

Bone ear scoops. (©Mary Rose Trust, Portsmouth, UK.)

Wooden medicament canisters with lids. (©Mary Rose Trust, Portsmouth, UK.)

Ceramic medicament jars (©Mary Rose Trust, Portsmouth, UK.)



Glass medicament bottles. (©Mary Rose Trust, Portsmouth, UK.)

Bandage roll: *spasmadrap* or ungent. (©Mary Rose Trust, Portsmouth, UK.)

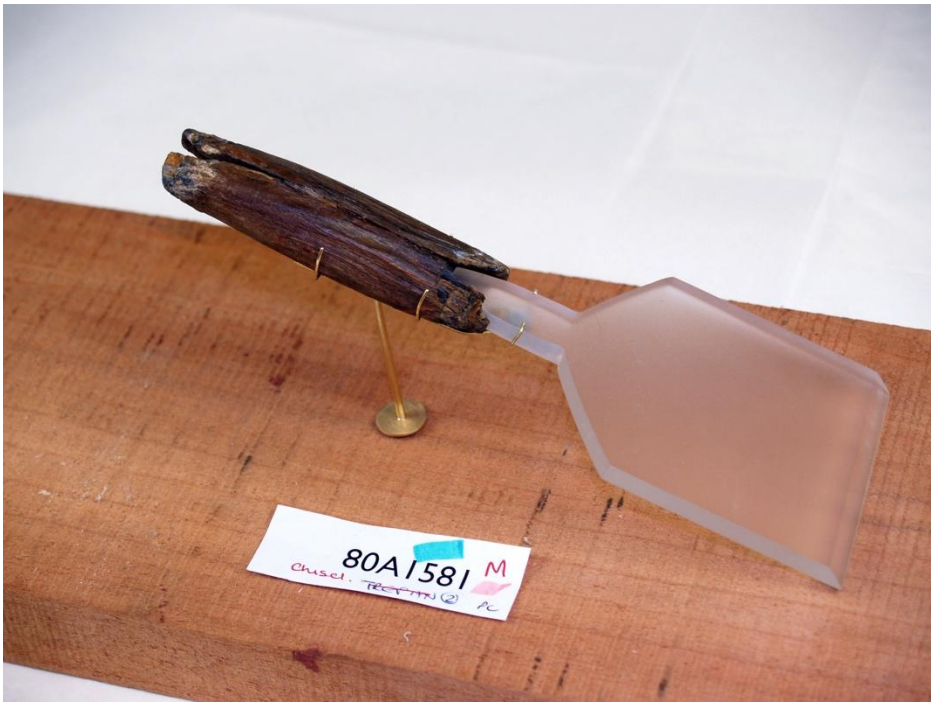
Bronze mortar. (©Mary Rose Trust, Portsmouth, UK.)

Bronze bowl or pan with replica handle. (©Mary Rose Trust, Portsmouth, UK.)

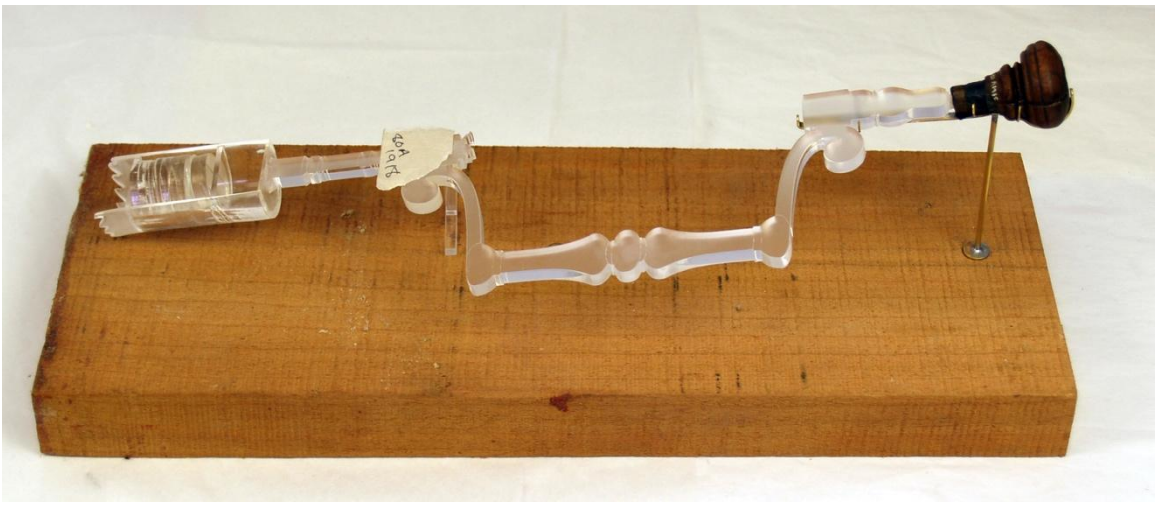
Saw handle. (©Mary Rose Trust, Portsmouth, UK.)

Decorative razor handle. (©Mary Rose Trust, Portsmouth, UK.)

Probe handles with replica probes. (©Mary Rose Trust, Portsmouth, UK.)



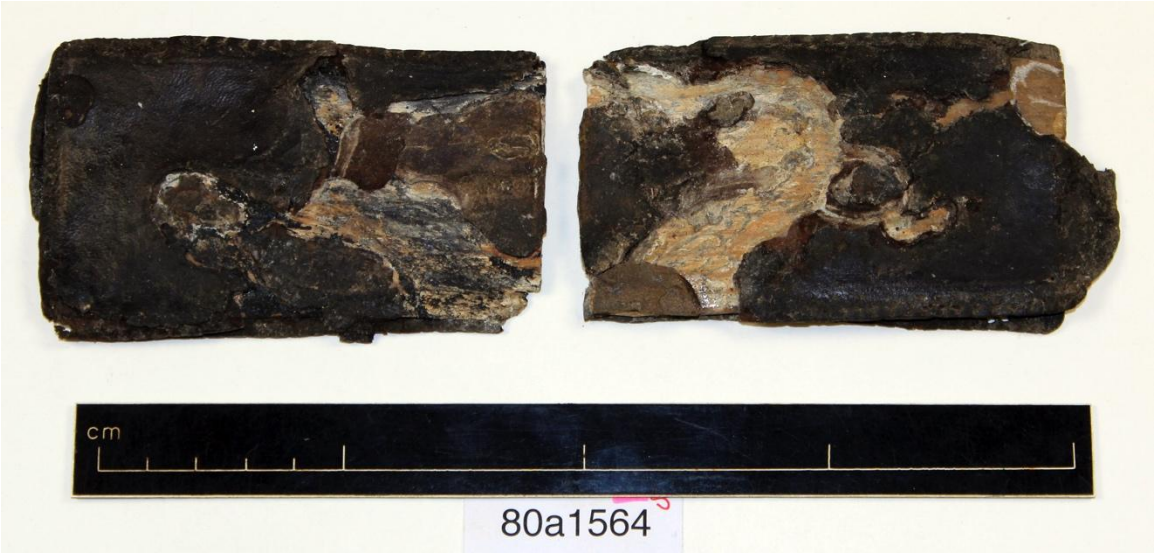
Handle with replica chisel. (©Mary Rose Trust, Portsmouth, UK.)



Trepan handle with replica trepan. (©Mary Rose Trust, Portsmouth, UK.)

Cautery handle. (©Mary Rose Trust, Portsmouth, UK.)

Knife handle. (©Mary Rose Trust, Portsmouth, UK.)



Fleam case. (©Mary Rose Trust, Portsmouth, UK.)

Medical objects from *Mary Rose*.

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Medical Use Only?	Notes
80A1558	Bandage Roll (?)	Textile	Linen	Recovery Care	Dressing	Medical Chest (80A1530)	Yes	*Spasmadrap*: ready-made plaster and/or bandage. Impregnated with a variety of oils and resins.
80A1892	Bandage Roll (?)	Textile	Linen	Recovery Care	Dressing	Medical Chest (80A1530)	Yes	*Spasmadrap*: ready-made plaster and/or bandage. Impregnated with a variety of oils and resins.
80A1893	Bandage Roll (?)	Textile	Linen	Recovery Care	Dressing	Medical Chest (80A1530)	Yes	*Spasmadrap*: ready-made plaster and/or bandage. Impregnated with a variety of oils and resins.
80A1894	Bandage Roll (?)	Textile	Linen	Recovery Care	Dressing	Medical Chest (80A1530)	Yes	*Spasmadrap*: ready-made plaster and/or bandage. Impregnated with a variety of oils and resins.
80A1895	Bandage Roll (?)	Textile	Linen	Recovery Care	Dressing	Medical Chest (80A1530)	Yes	*Spasmadrap*: ready-made plaster and/or bandage. Impregnated with a variety of oils and resins.
80A1896	Bandage Roll (?)	Textile	Linen	Recovery Care	Dressing	Medical Chest (80A1530)	Yes	*Spasmadrap*: ready-made plaster and/or bandage. Impregnated with a variety of oils and resins.
80A1503	Bench	Wood	Oak	Miscellaneous	Patient Care	Cabin 2-3, Main Deck	No	Treatment or plastering bench
80A1693	Bottle	Leather		Miscellaneous	Container	Cabin 2-3, Main Deck	No	Storage of water or wine; no pitch or waxy deposit/residue found.

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Medical Use Only?	Notes
80A1540	Bottle	Glass		Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Pale green; wrythen decoration. Complete.
80A1565	Bottle	Glass		Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Pale green; wrythen decoration. Cork bung. Complete
80A1631	Bottle	Glass		Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	Pale green; wrythen decoration. Cork bung. Broken
80A1555	Bottle	Wood	Maple	Recovery Care	Container	Medical Chest (80A1530)	Yes	Feeding bottle with lid. Used to feed very sick patients or those suffering from facial injuries
80A1618	Bowl	Metal	Cupric	Grooming	Barbering	Cabin 2-3, Main Deck	Yes	Shaving bowl with semi-circle cut out on lip and suspension ring.
80A1562	Bowl	Wood	Alder	Multipurpose	Container	Medical Chest (80A1530)	No	
80A1536	Bowl	Wood	Beech	Multipurpose	Container	Medical Chest (80A1530)	No	
80A1621	Bowl	Wood	Beech	Multipurpose	Container	Cabin 2-3, Main Deck	No	Found in three fragments.
80A1629	Bowl	Metal	Cupric	Pharmaceutical	Instrument	Cabin 2-3, Main Deck	Yes	Blackening on outside indicates use as a suspension pot with the chafing dish.
80A1676	Brush	Wood	Alder	Grooming	Barbering	Cabin 2-3, Main Deck	Yes	Hair care of crew members.
80A1865	Brush	Wood; Leather; Bristles	Unknown; Calf; Unknown	Grooming	Personal Care	Cabin 2-3, Main Deck	Yes	Hair care of crew members. Fragments of *Polytrichium* (hairmoss) trapped in bristles.

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Medical Use Only?	Notes
80A1612	Buckle + Strap			Miscellaneous	General	Medical Chest (80A1530)	No	
80A1619	Canister	Metal	Pewter	Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	Non-corrosive and non-liquid medicament container
80A1628	Canister	Metal	Pewter	Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	Non-corrosive and non-liquid medicament container
80A1582	Canister	Metal	Pewter	Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Non-corrosive and non-liquid medicament container. Stamped with rose on base.
80A1561	Canister	Wood	Poplar	Pharmaceutical	Container	Medical Chest (80A1530)	Yes	
80A1567	Canister	Wood	Poplar	Pharmaceutical	Container	Medical Chest (80A1530)	Yes	
80A1531	Canister	Wood	Poplar	Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Container held ointment.
80A1532	Canister	Wood	Poplar	Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Container held ointment.
80A1533	Canister	Wood	Poplar	Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Container held ointment.
80A1534	Canister	Wood		Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Container held ointment.
80A1535	Canister	Wood	Poplar	Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Container held ointment.

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Medical Use Only?	Notes
80A1536	Canister	Wood		Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Container held ointment.
80A1537	Canister	Wood	Poplar	Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Container held ointment.
80A1538	Canister	Wood	Poplar	Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Container held ointment.
80A1541	Canister	Wood	Poplar	Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Container held ointment.
80A1542	Canister	Wood		Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Container held ointment.
80A1551	Canister	Wood	Poplar	Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Container held ointment.
80A1526	Canister	Wood	Poplar	Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	Broken
80A1862	Canister	Wood		Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	
80A1638	Canister	Wood	Poplar	Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	Poplar
80A1690	Canister	Wood	Ash	Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	
80A1702	Canister	Wood	Ash	Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	
80A1703	Canister	Wood	Ash	Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	
80A1863	Canister	Wood		Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Medical Use Only?	Notes
80A1630	Canister	Wood	Poplar	Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	
80A1856	Cap	Textile	Velvet	Miscellaneous	Clothing	Cabin 2-3, Main Deck	No	Medical practitioner's cap
80A1626	Chafing Dish	Metal	Cupric	Pharmaceutical	Instrument	Cabin 2-3, Main Deck	Yes	
80A1530	Chest	Wood	Beech; Elm; Walnut	Multipurpose	Set	Cabin 2-3, Main Deck	No	Complete, dovetailed; elm handles and beech battens. Contained medical practitioner's instruments and personal belongings
80A1861	Coin(s)	Metal	Silver	Miscellaneous	General	Medical Chest (80A1530)	No	
83A0004	Coin(s)	Metal	Silver	Miscellaneous	General	Cabin 2-3, Main Deck	No	
80A1572	Comb	Wood	Boxwood	Grooming	Personal Care	Medical Chest (80A1530)	No	Crew grooming or personal use
80A1484	Comb	Wood	Boxwood	Grooming	Personal Care	Cabin 2-3, Main Deck	No	Crew grooming or personal use
No Number given	Dish	Wood	Beech	Miscellaneous	Container	Cabin 2-3, Main Deck	No	
80A1577	Ear Scoop	Organic	Ivory	Grooming	Personal Care	Medical Chest (80A1530)	Yes	Carved stem with banded end. Crew grooming
80A1524	Ear Scoop	Organic	Bone	Grooming	Personal Care	Cabin 2-3, Main Deck	Yes	Spoon is broken. Stipple carving and cross-hatching on grip. Crew grooming
80A1406	Flask	Metal	Pewter	Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	Left-handed screw cap. Non-corrosive liquid or oil container.

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Medical Use Only?	Notes
80A1455	Flask	Metal	Pewter	Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	Left-handed screw cap. Non-corrosive liquid or oil container. Residue analysis: volatile oil.
80A1610	Flask	Metal	Pewter	Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	Left-handed screw cap. Non-corrosive liquid or oil container.
80A1523	Fleam Case			Phlebotomy	Case	Cabin 2-3, Main Deck	Yes	
No Number given	Globules	Mercury		Pharmaceutical	Medicaments	Medical Chest (80A1530)	Yes	Found loose in the chest.
80A1581	Handle	Wood	Boxwood	Amputation	Instrument	Medical Chest (80A1530)	Yes	Square tang hole for chisel
80A1563	Handle	Wood	Boxwood	Multipurpose	Instrument	Medical Chest (80A1530)	Yes	Probe, specialist needle, or dental instrument handle
80A1566	Handle	Wood	Ash	Multipurpose	Instrument	Medical Chest (80A1530)	Yes	Rectangular tang hole. Hefty blade/bar like curved amputation knife or cautery iron.
80A1579	Handle	Wood	Boxwood	Multipurpose	Instrument	Medical Chest (80A1530)	Yes	Five incised bands. Probe or Seton needle handle
80A1580	Handle	Wood	Fruit wood	Multipurpose	Instrument	Medical Chest (80A1530)	Yes	Square tang hole with evidence of collar and nail in grip. Smaller cautery irons or chisels for ulcerated bone
80A1917	Handle	Wood	Cherry	Multipurpose	Instrument	Medical Chest (80A1530)	Yes	Handle for probe, hook, and/or specialized needles fitted similarly to a bradawl

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Medical Use Only?	Notes
80A1919	Handle	Wood	Alder	Multipurpose	Instrument	Medical Chest (80A1530)	Yes	Diamond tang hole. Cautery iron (?) handle
80A1920	Handle	Wood	Spruce	Multipurpose	Instrument	Medical Chest (80A1530)	Yes	Rectangular tang hole. Hefty blade/bar like initial amputation knife or cautery iron.
80A1539	Handle	Wood; Metal	Boxwood; Cupric	Multipurpose	Instrument	Medical Chest (80A1530)	Yes	Cupric collar at end of handle. Possibly specialist handled-needle or screw action tool
80A1588	Handle, Knife	Wood	Boxwood	Multipurpose	Instrument	Medical Chest (80A1530)	Yes	Phlebotomy or incision knife
80A1918	Handle, Probe (?)	Wood	Boxwood	Multipurpose	Instrument	Medical Chest (80A1530)	Yes	Cupric bands.Probe (?) handle
80A1912	Handle, Razor	Wood		Multipurpose	Instrument	Cabin 2-3, Main Deck	Yes	Found encased in a small wooden box
80A1913	Handle, Razor	Wood		Multipurpose	Instrument	Cabin 2-3, Main Deck	Yes	Iron pin at the end of the handle
80A1578	Handle, Saw	Wood; Metal	Cherry; Cupric	Amputation	Instrument	Medical Chest (80A1530)	Yes	Rebate at end for cupric cap/collar to fit an amputation bow saw.
80A1534	Jug	Ceramic		Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Salt-glazed ceramic; Raren pottery; single strap handle
80A1559	Jug	Ceramic		Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Salt-glazed ceramic; Raren pottery; single strap handle. Cork Bung fitted with waxed leather

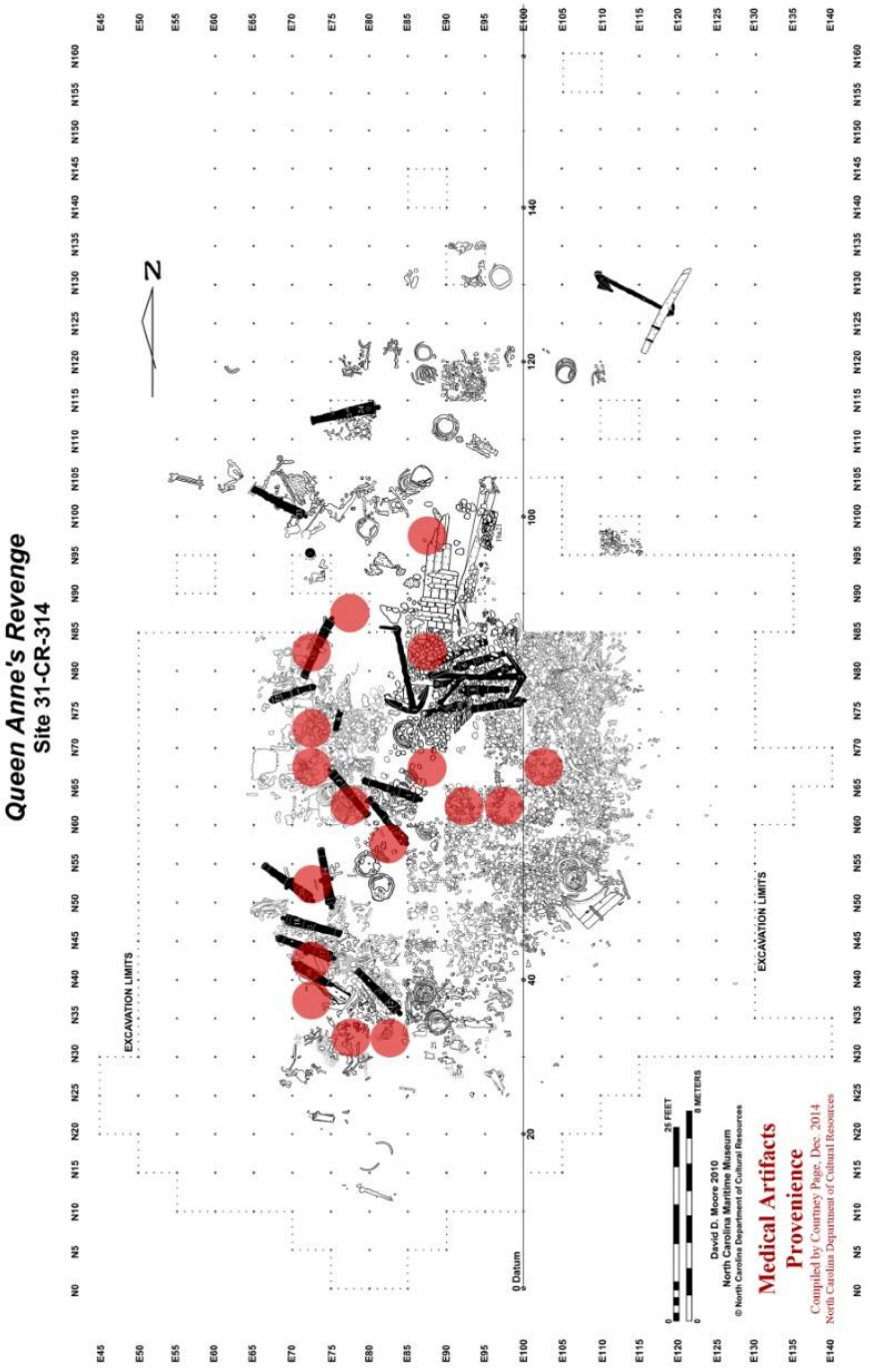
Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Medical Use Only?	Notes
80A1573	Jug	Ceramic		Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Salt-glazed ceramic; Raren pottery; single strap handle. Cork bung
80A1574	Jug	Ceramic		Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Salt-glazed ceramic; Raren pottery; single strap handle
80A1575	Jug	Ceramic		Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Salt-glazed ceramic; Raren pottery; double strap handle
80A1637	Jug	Ceramic		Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Salt-glazed ceramic; Raren pottery; single strap handle. Cork bung
80A1662	Jug	Ceramic		Pharmaceutical	Container	Medical Chest (80A1530)	Yes	Salt-glazed ceramic; Raren pottery; single strap handle. Cork bung
80A1483	Jug	Ceramic		Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	Tin-glazed (maiolica). Latticed medallion in yellow paint with white dots and dark blue/grey foliage design
80A1743	Mallet	Wood	Elm; Oak	Amputation	Instrument	Cabin 2-3, Main Deck	No	Elm head, oak handle. Used for amputations of digits.
80A1672	Mortar	Metal	Cupric	Pharmaceutical	Instrument	Cabin 2-3, Main Deck	Yes	Marked with "4" over two crosses
80A1733	Needle	Wood	Boxwood	Multipurpose	Instrument	Cabin 2-3, Main Deck	Yes	Used to stitch linen bandages together.
80A1625	Porringer	Metal	Pewter	Multipurpose	Instrument	Cabin 2-3, Main Deck	No	May have either been an eating or drinking vessel owned by the practitioner or used as a bleeding bowl. Stamped "WE"
80A1584	Purse	Leather	Calf	Miscellaneous	Container	Medical Chest (80A1530)	No	Leather thong closure (missing). Originally contained silver coins.

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Medical Use Only?	Notes
80A1570	Razor	Wood; Metal (Concretion)		Multipurpose	Instrument	Medical Chest (80A1530)	Yes	
80A1576	Razor	Wood; Metal (Concretion)		Multipurpose	Instrument	Medical Chest (80A1530)	Yes	
80A1921	Razor	Wood; Metal (Concretion)		Multipurpose	Instrument	Medical Chest (80A1530)	Yes	
80A1922	Razor	Wood; Metal (Concretion)		Multipurpose	Instrument	Medical Chest (80A1530)	Yes	Iron pin at the solid end of the handle
80A1923	Razor	Wood; Metal (Concretion)		Multipurpose	Instrument	Medical Chest (80A1530)	Yes	
80A1924	Razor	Wood; Metal (Concretion)		Multipurpose	Instrument	Medical Chest (80A1530)	Yes	
80A1925	Razor	Wood; Metal (Concretion)		Multipurpose	Instrument	Medical Chest (80A1530)	Yes	Found encased in a small wooden box
80A1525	Razor	Wood; Metal (Concretion)		Multipurpose	Instrument	Cabin 2-3, Main Deck	Yes	Found encased in a small wooden box
80A1571	Shoe	Leather		Miscellaneous	Clothing	Medical Chest (80A1530)	No	
80A1557	Spatula	Wood	Pine	Pharmaceutical	Instrument	Medical Chest (80A1530)	Unknown	Complete; rounded ends.
80A1587	Spatula	Wood	Pine	Pharmaceutical	Instrument	Medical Chest (80A1530)	Unknown	Complete; rounded ends.

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Medical Use Only?	Notes
80A1915	Spatula	Wood	Beech	Pharmaceutical	Instrument	Medical Chest (80A1530)	Unknown	Broken
80A1927	Spatula	Wood	Pine	Pharmaceutical	Instrument	Medical Chest (80A1530)	Unknown	Complete; rounded ends.
80A2063	Spatula (?)	Wood		Pharmaceutical	Instrument	Medical Chest (80A1530)	Unknown	Fragment
80A1675	Spoon	Wood	Alder	Recovery Care	General	Cabin 2-3, Main Deck	No	Used to feed very sick patients
80A1608	Strap	Leather		Miscellaneous	General	Medical Chest (80A1530)	Unknown	
80A1560	Syringe	Metal	Cupric	Multipurpose	Instrument	Medical Chest (80A1530)	Yes	
80A1741	Syringe	Metal	Pewter; Bronze	Multipurpose	Instrument	Cabin 2-3, Main Deck	Yes	Pewter body and plunger; bronze pipe. Associated leather washer found nearby.
81A5738	Syringe	Metal; Leather	Cupric	Multipurpose	Instrument	Area 11, Orlop Deck	Yes	Leather washer intact.
80A1617	Tankard	Wood	Pine; Other	Miscellaneous	Container	Cabin 2-3, Main Deck	No	
80A1975	Tankard	Wood	Pine; Lime	Miscellaneous	Container	Cabin 2-3, Main Deck	No	
80A1585	Trepan (?)	Metal		Multipurpose	Instrument	Medical Chest (80A1530)	Yes	Found concreted to the handles of the medical chest (80A1530). Tubular object, originally with teeth around the edge.

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Medical Use Only?	Notes
80A1459	Vessel	Ceramic		Pharmaceutical	Container	Cabin 2-3, Main Deck	Yes	Iberian Red Micaceous ware. Residue analysis: *Polypodium vulgare* (fern oil) mixed with animal fat.
80A1564	Wallet	Leather		Phlebotomy	Case	Medical Chest (80A1530)	Yes	Contained fleams or lancets
80A1569	Whetstone	Stone	Micaceous Phyllite	Miscellaneous	General	Medical Chest (80A1530)	Yes	Used to sharpen bladed instruments
80A1586	Whistle	Metal	Cupric	Miscellaneous	General	Medical Chest (80A1530)	Unknown	Unknown purpose. May have been used to perform hearing tests.

Appendix II: Comparative Data Recovered From *Queen Anne's Revenge*



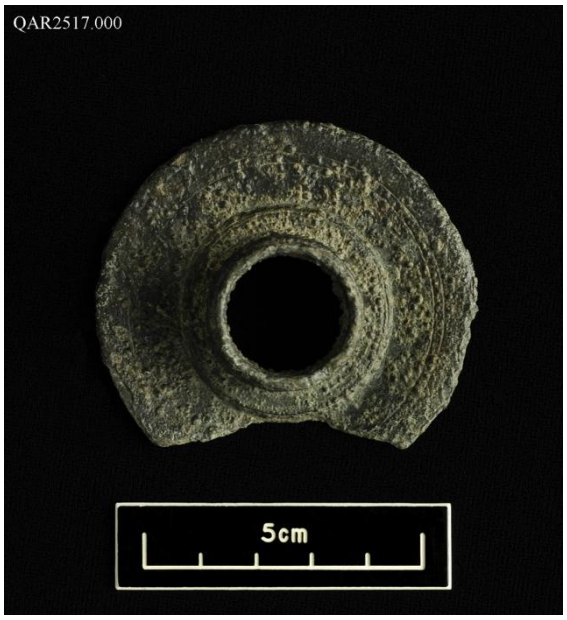
Site plan of *QAR* shipwreck showing key features and location of medical artifacts, indicated by red dots, recovered by 2016.. (Site plan adapted from 2010, courtesy of North Carolina Department of Natural and Cultural Resources, David D. Moore and Courtney Page, Raleigh, NC.)

Cupric mortar. (Photo by Wendy Welsh; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

Cupric pestle. (Photo by Wendy Welsh; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

Fragment of a clyster syringe. (Photo by Wendy Welsh; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

Enlargement of maker's mark on clyster syringe fragment. (Photo by Wendy Welsh; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)



Clyster syringe fragment (top), overhead view. (Photo by Shanna Daniel; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

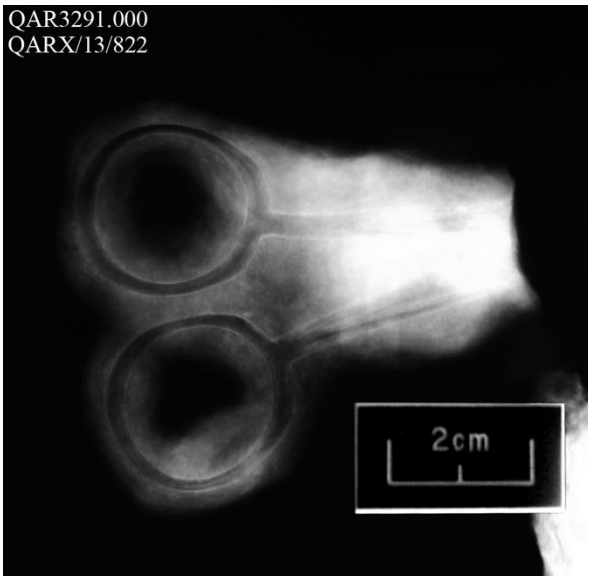
Clyster syringe fragment (top), side elevation. (Photo by Shanna Daniel; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

Clyster syringe fragment, side elevation. (Photo by Jeremy Borrelli; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

Clyster syringe fragment, end view. (Photo by Jeremy Borrelli; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

Pewter urethral syringe. (Courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

Pewter porringer. (Courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)



Scissor handles, X-Ray. (Photo by Kimberly Kenyon; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

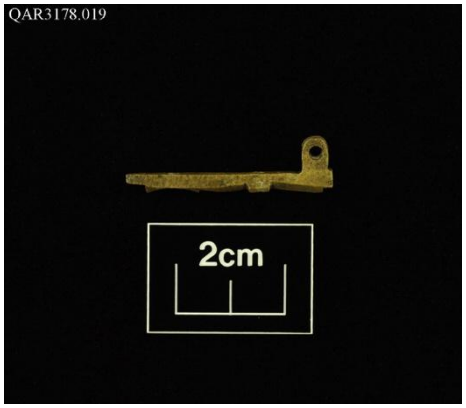
Scissor handles, cast. (Photo by Kimberly Kenyon; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

Nesting weights. (Photo by Wendy Welsh; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

Nesting weights stacked. (Photo by Wendy Welsh; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

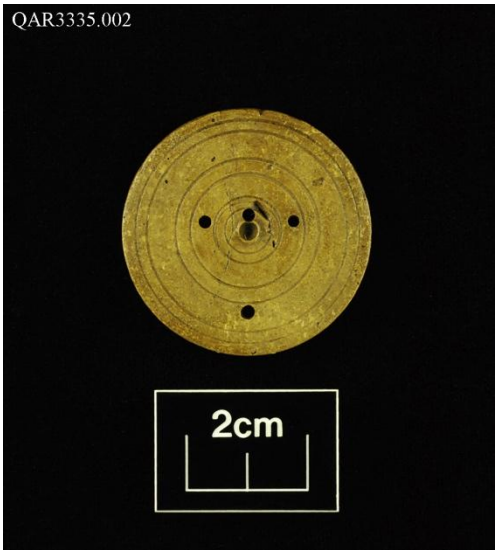
Nesting weight with imprinted "2" and fleur de lis; part of the larger set. (Photo by Wendy Welsh; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

Master cup from nesting weight set. Imprinted with fleur de lis and an N•C cartouche. (Photo by Wendy Welsh; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)



Hinge from a nesting weight set. (Photo by Elise Carroll; courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

Lid from a nesting weight set. (Courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)



Lid from a nesting weight set. (Courtesy of North Carolina Department of Natural and Cultural Resources, Raleigh, NC.)

Medical objects from *QAR*.

Catalog Number (QAR Prefix)	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Prov. East	Prov. North	Medical Use Only?	Notes
1904.000	Clyster Syringe	Metal	Pewter	Multipurpose	Instrument	130	72	54	Yes	Fragment: top part of clyster syringe (possible association to QAR2517.000)
2517.000	Clyster Syringe	Metal	Pewter	Multipurpose	Instrument	166	77.5	62.5	Yes	Fragment: bottom part of clyster syringe (possible associated with top part of QAR1904.000)
3471.000	Clyster Syringe	Metal, Organic	Pewter, Plant Fiber	Multipurpose	Instrument	227	95	62.5	Yes	
3840.001	Fragment	Metal	Pewter	Multipurpose	Instrument	268, Dredge Spoil	76	85.5	No	Possible section from a clyster syringe
3178.019	Hinge	Metal	Cupric	Pharmaceutical	Instrument	206, Dredge Spoil	85	80	No	From a nesting weight set
2590.008	Latch	Metal	Cupric	Pharmaceutical	Instrument	168	95	62.5	No	Fragment. From set (2590.000)

Catalog Number (QAR Prefix)	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Prov. East	Prov. North	Medical Use Only?	Notes
3335.002	Lid	Metal	Cupric	Pharmaceutical	Instrument	224, Dredge Spoil	75	64	No	From a nesting weight set
3810.001	Lid	Metal	Cupric	Pharmaceutical	Instrument	256, Dredge Spoil	87.5	97.5	No	From a nesting weight set
2590.007	Master Cup	Metal	Cupric	Pharmaceutical	Instrument	168	70	50	No	Part of Set (2590.000): 1 fleur de lis to the side, '<' symbol, Maker's Mark: N dot C with fleur de lis over the letters and '8' stamped over another maker's mark
714.000	Mortar	Metal	Cupric	Pharmaceutical	Instrument	166	70	50	Yes	Apothecary Use
473.000	Nesting Weight	Metal	Cupric	Pharmaceutical	Instrument	293	70	50	No	Y' stamped inside base
1903.001	Nesting Weight	Metal	Cupric	Pharmaceutical	Instrument	130, Dredge Spoil			No	

Catalog Number (QAR Prefix)	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Prov. East	Prov. North	Medical Use Only?	Notes
1903.017	Nesting Weight	Metal	Cupric	Pharmaceutical	Instrument	130, Dredge Spoil	95	62.5	No	
1903.030	Nesting Weight	Metal	Cupric	Pharmaceutical	Instrument	130, Dredge Spoil	95	62.5	No	
2590.001	Nesting Weight	Metal	Cupric	Pharmaceutical	Instrument	168	95	62.5	No	Part of Set (2590.000). No marking
2590.002	Nesting Weight	Metal	Cupric	Pharmaceutical	Instrument	168	95	62.5	No	Part of Set (2590.000). No marking but crack in side of weight
2590.003	Nesting Weight	Metal	Cupric	Pharmaceutical	Instrument	168	95	62.5	No	Part of Set (2590.000). 1 fleur de lis stamped on bottom of inside of weight
2590.004	Nesting Weight	Metal	Cupric	Pharmaceutical	Instrument	168	95	62.5	No	Part of Set (2590.000). Stylized '1' stamped over a fleur de lis

Catalog Number (QAR Prefix)	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Prov. East	Prov. North	Medical Use Only?	Notes
2590.005	Nesting Weight	Metal	Cupric	Pharmaceutical	Instrument	168	101.5	68.5	No	Part of Set (2590.000). 1 fleur de lis to the side and a '2' stamped over another fleur de lis
2590.006	Nesting Weight	Metal	Cupric	Pharmaceutical	Instrument	168	83	55-56	No	Part of Set (2590.000): 1 fleur de lis to the side and a '4' stamped over another fleur de lis
2741.000	Nesting weight	Metal	Cupric	Pharmaceutical	Instrument	180	72.5	43.5	No	
2590.000	Nesting Weight Set	Metal	Cupric	Pharmaceutical	Instrument	168	70.5	72	No	Set of nesting weights
2310.000	Pestle	Metal	Cupric	Pharmaceutical	Instrument	156	74	35.5	Yes	

Catalog Number (QAR Prefix)	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Prov. East	Prov. North	Medical Use Only?	Notes
2350.000	Porringer	Metal	Pewter	Phlebotomy	Container	101	70	50	No	Two handles; shallow bowl is flattened. Marked with a fleur de lis, 'M', and 'I'; manufactured along east coast of France sometime during 17th century
3291.001	Scissors	Metal	Synthetic Casting	Multipurpose	Instrument	207	85	65	No	
308.001	Syringe	Metal	Pewter	Multipurpose	Instrument	75	70	65	Yes	Urethral syringe. Analysis of contents: Mercury with lithics (sand/silt/clay) from the site.

Catalog Number (QAR Prefix)	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenience	Prov. East	Prov. North	Medical Use Only?	Notes
418.042	Vessel Sherd	Ceramic		Pharmaceutical	Container	244/245/294/295	70	80	No	Vessel VI (LCM) body sherd, possible shoulder near rim
1903.018	Weight	Metal	Cupric	Pharmaceutical	Instrument	130, Dredge Spoil	95.6	98.5	No	'1/4' stamped on face

Appendix III: Assemblage Data From The Mütter Museum

Copper bleeding bowl. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Ceramic bleeding bowl. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Cupping set with scarificator. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Horn cupping cup with brass stopcock bottom. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Pewter syringe with wood plunger. Possibly used to treat diabetes. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Pewter syringe with wood plunger for obstetrical enemas. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Wooden mortar and pestle from Austria, ca. 1750. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Brass mortar and pestle. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Wooden mortar and pestle. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Double pan tabletop scale. (Courtesy of The Mütter Museum, Philadelphia, PA.)

French hand balance with weights and case. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Apothecary kit including scales, ceramic dish, weights, and spatula. (Courtesy of The Mütter Museum, Philadelphia, PA.)

U.S.A. Hospital Department amputation and surgical set. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Surgical scissors. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Surgical set with hemostats. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Surgical set. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Medicine chest of Benjamin Rush, M.D. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Cupping set with scarificator and spirit lamp. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Cupping set with syringe. (Courtesy of The Mütter Museum, Philadelphia, PA.)

Selected collection from The Mütter Museum.

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenance	Medical Use Only?	Notes
MISC-2064	Bleeding Bowl	Ceramic		Phlebotomy	Container	Lawrence Abel, M.D.	Yes	Painted; missing from the collection
1994.5.2	Bleeding Bowl	Metal	Copper	Phlebotomy	Container	Donated by Gloria Hamilton	Yes	
16019.00	Chest and contents	Wood, Glass, Paper, Metal, Textile, Chemicals		Multipurpose	Set	Ernest Christian Bethansen, M.D.	Yes	Late 18th century. Content materials: glass, paper, brass, textile, cork, assorted chemicals/medicaments
16003.00	Chest and contents	Wood, Glass, Parchment, Metal, Ceramic, Chemicals		Multipurpose	Set	Benjamin Rush	Yes	Internal Medicine. ca. 1770-1800. Contents: 16 glass bottles (various labels), 1 ceramic pill tile, 1 Wood-handled spatula, 3 Jars capped with parchment, 6 Glass-stoppered bottles, 2 unidentified materials (for

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenance	Medical Use Only?	Notes
								waxing thread), 1 Glass rod, 1 set Apothecary scales and weights, 1 small Glass mortar and pestle, 1 tall Glass beaker; assorted chemicals/medicaments
2015.1.2	Cupping Cup	Horn, Metal	Brass	Phlebotomy	Instrument	Original owner: William Pinckney Hatchett, M.D., Practitioner in Texas and Georgia	Yes	Brass stopcock bottom. ca. 1840
2015.1.3	Cupping Cup	Horn, Metal	Brass	Phlebotomy	Instrument	Original owner: William Pinckney Hatchett, M.D., Practitioner in Texas and Georgia	Yes	Brass stopcock bottom. ca. 1840

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenance	Medical Use Only?	Notes
17131.16	Cupping Set	Metal, Glass, Wood, Textile	Steel; Brass	Phlebotomy	Set	J. M. DaCosta, M.D.	Yes	Glass catch cups, 8-bladed scarificator, syringe
17831.15	Cupping Set	Metal, Glass, Wood, Textile	Steel; Brass; Leather	Phlebotomy	Set	W.E. Chamberlain, M.D.	Yes	Part of larger blood letting kit: 2 12-bladed scarificators, 7 cupping glasses, alcohol lamp
MISC-1091	Cupping Set	Metal, Glass, Wood, Textile	Steel; Cupric; Velvet	Phlebotomy	Set	William Pepper, M.D.	Yes	Wood box with separate compartments for each of the instruments: 5 cupping glasses with metal attachments, syringe, and screw.
17133.12	Cupping Set			Phlebotomy	Set	Unknown	Yes	Cupping set with pump
17291.10	Cupping Set			Phlebotomy	Set	Unknown	Yes	Dry cupping set
E2011.10.1	Mortar and Pestle	Metal	Brass	Pharmaceutical	Instrument	Terry Ann Glauser, M.D.	No	

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenance	Medical Use Only?	Notes
1056-MISC	Mortar and Pestle	Wood		Pharmaceutical	Instrument	Austria	No	ca. 1790
E2011.10.15	Mortar and Pestle	Wood		Pharmaceutical	Instrument	Terry Ann Glauser, M.D.	No	
MISC-1493	Mortar and Pestle	Wood		Pharmaceutical	Instrument	Concord, MA. Previously owned by Edward B. Krumbhaar, M.D.	No	Local manufacture and use.
2000.6.5	Saw	Metal, Ivory	Steel	Amputation	Instrument	Stanley Kelley, D.O.	Yes	Bone saw with steel blade and uncarved ivory handle
16010.02	Scale	Wood, Metal, Ceramic	Lead, Steel, Unidentified Metal	Pharmaceutical	Set	Unknown	Yes	Apothecary kit, ca. 19th century. Mahogany box. Contents: weights (varying sizes), apothecary scales, small ceramic dish, spatula
MISC-1099	Scale	Metal	Steel; Brass	Pharmaceutical	Instrument	Edward B. Krumbhaar, M.D.	No	French hand balance and weights, ca. 19th century.

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenance	Medical Use Only?	Notes
F2011.1	Scale	Wood, Metal	Steel; Brass	Pharmaceutical	Instrument	Henry Troemner, maker.	No	Double pan balance scale on rough wooden base.
1988.16.98	Scissors	Metal	Steel	Multipurpose	Instrument	Myer Solis-Cohen, M.D.	Yes	Angled surgical scissors, ca. 19th century
17823.87	Surgical Kit	Wood, Metal		Amputation	Set	USA Hospital Department (US Army Civil War); J.H. Gemrig, maker. Philadelphia, PA	Yes	ca. 1841. Contents: large bone-cutting forceps, 2 gnawing forceps, ecraseur-chassaignac, chainsaw, lenticlar, straight-edge chisel, bone gouge. Missing from kit: retractors, trephine, gutta percha pouch
F1995.75	Surgical Kit	Metal, Wood, Textile, Ivory	Steel; Velvet; Leather	Multipurpose	Set	D.W. Kolbe Manufacturer.	Yes	Obstetrics specialty. Contents: Top compartment 10 ivory handled instruments (wire adjuster, double tenculum, 2 aneurism needles, 2 retractors, 2 suture needles, 2 knives).

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenance	Medical Use Only?	Notes
								Bottom compartment - lead shot, suture needles, scissors, shot compression forceps, Agnew's combined forceps/adjuster, long curved knife (not original to set).
16500.08.4	Surgical Kit	Wood, Metal		Multipurpose	Set	Henry Schively, maker. Philadelphia, PA	Yes	Field surgery kit. Contents: amputation saws, surgical knives, trepanation tools, tourniquet.
16500.08.6	Surgical Kit	Wood, Metal	Steel	Multipurpose	Set	Elisha Kent Kane	Yes	Small surgical kit. Contents: scissors, hemostat clamps, forceps, probes
17824.42	Syringe	Metal		Multipurpose	Instrument	John Foulke, M.D.	Yes	Esmarch cut-off self syringe; missing from the collection.
17090.90	Syringe: Enema	Metal	Pewter	Multipurpose	Instrument	Unknown	Yes	Obstetrical specialty

Catalog Number	Object	Material (General)	Material (Specific)	Type (General)	Type (Specific)	Provenance	Medical Use Only?	Notes
MISC-2272	Syringe: Enema	Metal	Pewter	Multipurpose	Instrument	Unknown	Yes	Obstetrical specialty
2002.10.34	Syringe: Enema	Metal, Wood	Pewter	Multipurpose	Instrument	Used by Dr. Cornman who was affiliated with Bryn Mawr Hospital	Yes	Pewter body, wood plunger. ca. 1800