STERILE PROCESSING BASIC TRAINING: SPD BOOT CAMP®

Module #2B:
A Brief Historical Survey of the Development of Sterile Processing

by

The Central Sterile Processing Initiative

Sterile Processing Basic Training: SPD Boot Camp

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Message From The Central Sterile Processing Initiative Director

Thank you for purchasing this e-course, an introductory and review survey of the basics of sterile processing, *Sterile Processing Basic Training: SPD Boot Camp.* Thank you, enjoy the program, and I am always just an e-mail away if you have questions or need my assistance during the course of your studies. Sincerely, Shane Huey, Director	www.centralsterileprocessing.net

Preface

This e-course is neither the traditional textbook nor the typical student workbook. It is, rather, a combination of the best and most relevant of information related to the basics of sterile processing education and training presented much like a series of lecture notes with multimedia elements included for a more complete and well rounded educational experience for both sterile processing "newbies" and seasoned veterans simply seeking a comprehensive review alike.

The content is structured as a classroom lecture/text with all relevant points discussed and references provided for further information and investigation.

In this text one will be presented with material contained within the industry standard texts, current field relevant articles, and as well have workspace much like contained within the likewise standard workbooks. Herein, however, the student will find no superfluous material to bog one down unnecessarily. Covered within is only that which one needs to know as a sterile processing tech at the level 1 stage—the ESSENTIALS of sterile processing, that which every tech need know—the prerequisites of the field. References will be cited throughout the course, however, to point students in the right direction should they choose (and we are trusting that they will!) to pursue additional knowledge, training, and advancement in the field of sterile processing.

The course consists of multiple individual modules (at least 15 at the time of this printing). Please read through each module from beginning to end at least once before attempting to complete the assignments and then work your way back through the text completing the required coursework specified in the assignment directions at the end of the module (see contents).

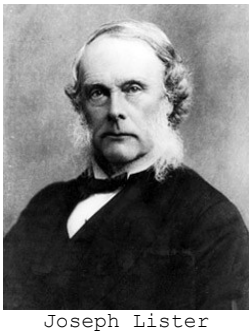
Module 2B

Module Objectives

- Understand the importance of the role of Joseph Lister to antiseptic surgery and his influence on, and contributions to, technological advancements in asepsis

- Understanding of developments in sterilization and mechanical sterilizers to modern day

A Brief Historical Survey of the Development of Sterile Processing



Joseph Lister

"Father of Antiseptic Surgery"
Joseph Lister (1827-1912), recognized by most as the father of antiseptic surgery, contributed much to both the modern understanding and practice of aseptic technique. Before discussing Lister's contributions further, it will first be helpful to clarify just what is meant by the term *asepsis*.

There are 3 specific terms relevant to the current discussion:

- **aseptic**-to be free from microbiological contaminatnts; related to contaminant free procedure
- **asepsis**-absence of pathogenic (disease causing) organisms
- **medical/surgical asepsis**-medical and/or surgical procedures aimed at minimization of microbiological count

The achievements of Lister, in terms of antiseptic technique, are all the more remarkable when one considers the fact that he was able to reduce incidence of infection in the surgical setting by implementation of his techniques prior to the full understanding that microorganisms, both growing in the body and infiltrating from the external environment (i.e., germ theory), were causally responsible for the occurrence of infection in patients (Perkins 17).

Lister was the first surgeon to utilize chemical agents to prepare and maintain an "antiseptic atmosphere" (Perkins 15) in the surgical

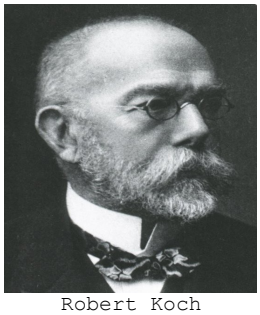
setting thus minimizing microbial counts such that the growth and spread of pathogenic bacteria was inhibited resulting in a dramatic decline in post-operative infection. In the incidence of compound fracture, Lister, via application of his antiseptic principles, was able to reduce infection rates associated with mortality from 45% to 9%--an astounding achievement when one considers that modern germ theory had yet to be fully formulated (Perkins 16).

Lister is responsible for the implementation of sterilization of surgical instrumentation and other supplies used both pre and post-operatively in the OR setting—practices which continue today, albeit in a more sophisticated form (Perkins 16).

The primary chemical utilized by Lister in his early antiseptic endeavors was carbolic acid. Carbolic acid (phenol) is an organic, water soluble, acidic compound that was first recognized in 1834 and obtained through coal tar extraction. Though carbolic acid does have certain antiseptic properties, it also had some commensurate negative effects as well, such as skin irritation and bleaching when applied in surgical aseptic settings. Carbolic acid has also been utilized, historically, as an embalming agent and as a human exterminating agent (e.g., in Nazi Germany).

Toward the Modern Sterilizer: German Contributions

The Germans contributed substantially to the emergence of the modern steam sterilizer as it is known today. Early researchers, e.g., Robert Koch (1843-1910), considered one of the founding fathers of modern bacteriology, produced work on the effects of heated air and steam on microbes launching the modern paradigms of disinfection and sterilization (Perkins 17). Most of the early experiments were accomplished with the bacteria anthrax (spores demonstrating a modicum of heat resistance).



Robert Koch

Dry heat proved to be less effective overall in sterilization and microbial deactivation in contrast to moist heat (steam) and as such research efforts would from herein on out be primarily concerned with steam as the preferred sterilization methodology. (Moist heat as steam proved to penetrate more fully due to saturation over and above dry heat.)

Early on, the Germans utilized a version of non-pressurized steam sterilizer in their investigations though they did recognize that pressurized steam was the more effective sterilant (Perkins 19). Pressurization aids substantially in the penetration of steam.

A researcher in disinfection and sterilization by the name of Ervin von Esmarch (1855-1915) contributed to the above discoveries and developments of Koch and further emphasized the necessity of adequate steam saturation (moist heat) in sterilization. He noted the correlation between maximum saturation and efficacy of sterilization. As well, von Esmarch noted that the presence of excess air reduced the efficacy of steam sterilization (this would lead to future developments in vacuum sterilization, which the student will study at more depth in the sterilization modules).

Though the Germans made significant advancements in disinfection (chemical) and sterilization (steam) in the period 1885-1900, it wouldn't be until, some time later, American contributions to the

field would result in the widespread manufacture of systems implementing the above technologies and be placed into common usage in the healthcare setting (Perkins 21-22).

American Contributions to Sterilization

It must be noted that the rise of and advancements in the science of bacteriology resulted in the subsequent, in fact drove, advancements in the field of sterilization. Disinfection was already a field of advanced inquiry and experimentation in the states and much of the European sterilization technology was already in place here as well. A major topic of study at the time was thermal mortification of pathogenic bacteria (particular time of death at temperature for specific bacteria).

It is believed that the age of sterilizer manufacturing in the U.S. began in earnest around 1895 though few to no records exists(Perkins 24). One of the early manufacturers of steam sterilizers was the Shipman Engine Company of Rochester (Rochester, NY) for the Sprague-Schuyler Company. This company was later acquired by the individuals who founded AMSCO (the American Sterilizer Company) circa 1900 (Perkins 27).

One early effort focused on disinfection via steam coupled with formaldehyde (a disinfecting agent). One such system was the Kinyoun-Francis chamber. This system consisted of a chamber that was constructed with an outer jacket around the chamber. Items for disinfection were placed on a rack within the chamber, air was evacuated via a vacuum mechanism, formaldehyde gas was pumped into the main chamber and the steam into the jacket to heat the chamber to a steady temperature to increase the efficacy of the formaldehyde gas. Note: As early as 1899 it was noted by those in the field that formaldehyde was not as efficacious in microbiological mortification as thought previously and as such it was all but abandoned.

Early (1900-1915) pressurized steam sterilization systems utilized a vacuum removal of chamber air from the autoclave and steam was then injected at 15-20 lbs of pressure for a period of at least 20 minutes (Perkins 33). Post 1915, the trend was toward gravity displacement of sterilizer chamber air. Such systems depended upon gravity to remove chamber air, as opposed to a vacuum. Subsequent to gravity dispersal steam would then be entered into the chamber for sterilization.

Problems were encountered early on and there were many instances of sterilization validation failure observed. One of the key issues was that the sterilization process could not be fully and closely monitored.

Sterilization Today

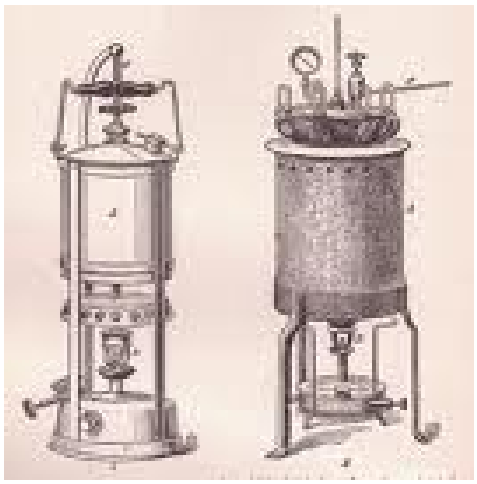
As discussed in a previous module, it is said that the modern age of sterilization began in earnest in 1933 with AMSCO's release of the first commercially viable steam autoclave that provided for the measurement of temperature via mercury thermometer (Perkins 38, Chobin 2). Prior to this particular and important technological enhancement, pressure was the sole metric. The monitoring of pressure, however, did not provide enough insight into the sterilization process and as such a lesser modicum of sterilization validation was to be had.

Key Points in the History of Sterilization
(See Perkins, 40-41 for full list of key moments and developments in the history of sterilization.)

- 1680-Denys Papin invents the first "autoclave," essentially a modern day pressure cooker. Papin was a French physicist.
- 1765-Lazarro Spallanzani studies the effects of heat upon bacteria
- 1832-William Henry makes advances with his work in dry heat disinfection and sterilization
- 1847-Ignaz Semmelweis pioneers the field of asepsis
- 1861-Louis Pasteur, a French chemist and bacteriologist, refutes the theory of spontaneous generation and infers infection is resultant from microbial growth
- 1867-Joseph Lister, influenced heavily by the work of Pasteur, advances the field of asepsis; considered father of modern antiseptic technique in surgery
- 1877-John Tyndall discovered the spore phase of bacteria (the heat resistant phase; Tyndal was an English physicist.
- 1880-Charles Chamberland constructs the first pressurized steam autoclave
- 1888-Ervin von Esmarch advanced sterilization science with his work with superheated steam; first advocate of biological indicators for sterilization validation
- 1933-Weeden Underwood contributed technological designs and improvements to the autoclaves of his day that are now standard components of steam sterilizers; formalized the concept of centralization of central supply/sterile processing

Sterilizer Images

(The images below are of varying types of pre-modern steam sterilizer. Not all sterilizers were/are utilized in the healthcare setting but as well in the food industry in the processing of certain fruits and vegetables, e.g., in canning.)



Bassine à blanchir à vapeur, pour la cuisson préalable des légumes à conserver.

Required Readings, Recommended Readings,and Other Resources

Required Reading
Module 2A
Module 2B
"Joseph Lister and Antiseptic Surgery"
Biography of Robert Koch
"Sterilisation and Disinfection"
How Autoclaves Work
"The World of Autoclaves"
Wikipedia: Autoclave

Recommended Reading
Perkins, John C. *Principles and Methods of Sterilization in Health Sciences, Second Edition.* Springfield: Charles C. Thomas, 1982. Chapter 1.

Recommended Links
N/a this module.

Module Assignments

Module 2B Assignments

1) Read the module in its entirety from cover to cover at least once. Also, complete the other required readings.

2) Write a 2-3 paragraph essay (all essays to be completed in Word, Works or similar, common word processing/text application) chronicling the major advancements in disinfection and sterilization covered in this module up to the modern era.

3) Pick 1 of the several key individuals covered in the module. Research either online or via text the individual chosen and write a brief, 2-3 paragraph essay on the individual (must be information not covered in the module but relevant to the topic of the module).

4) Find 3 sites on either aseptic technique, disinfection, and/or sterilization. List the links to the site and provide 3 pieces of information learned from each one of the sites.

5) Listen to the brief audio discussion on the course module site for this particular module. Write a brief 1-2 paragraphs on the importance of the topic of module 2 per the guidelines and discussion in the audio component.

6) Research (via traditional text or web search) Louis Pasteur, the French chemist and bacteriologist. 1) Briefly discuss Pasteur's relationship to Joseph Lister. 2) Briefly discuss Pasteur's notion of fermentation and describe how this relates to disinfection and sterilization. 3) List and define a process named after Pasteur.

7) Take the module quiz (posted online separately 5-7 days after posting of this module). Submit with above documents to info@centralsterileprocessing.net. In subject line, type "Module 1 Assignments." In body of e-mail, submit full name.

END MODULE 2B