Issue 13 FALL 2022

History of Pharmacy SIG Newsletter

Pharmacy Chronicles: Past, Present, and Future

Welcome Message from the Chair, History of Pharmacy Special Interest Group

Who am I? Who are We? –

As chair for the History of Pharmacy SIG I want to take this opportunity to introduce myself and tell you about who I am. When I entered the Philadelphia College of Pharmacy, I envisioned a career as a pharmacist in my hometown independent pharmacy. Although in a few years my interest changed to pursuing hospital pharmacy. I learned how to prepare sterile admixtures and unit dose drug distribution. But it was observing a pharmacist (first name George) performing pharmacokinectic calculations that opened my eyes to opportunities beyond drug distribution. He shared with me that a clinical pharmacist was only a title but what defines a pharmacist are professional attributes like altruism, duty, empathy, and respect for others that one commits to every day.

Upon graduation I served as a U.S. Army pharmacy officer working evaluating serum drug levels, recommending antibiotic therapy, and attending codes. I practiced clinical pharmacy but remained focused on living out the professional attributes George stressed to me. After six years, I returned to school to pursue my Pharm.D. where professors David Hawkins and Joe DiPiro taught me pharmacotherapy and the interpersonal skills, I needed to possess to be an effective contributor to team-based care. Like George they too model the same professional attributes reinforcing the work ethic I would use throughout my career.

As I look at a 40-year career working in various settings to include hospital, ambulatory care, industry, and academia each with new roles and responsibilities I strove to be the type of pharmacist shown to me by first George and then Drs. Hawkins & DiPiro. Recently I have been considering efforts to define a pharmacist's professional identity. Historically pharmacists have been characterized as makers of medicines, pill-pushers, pill counters, health advisers, medicine experts, managers, clinicians, and substitutes for general practitioners.[1] Additionally, Kellar J. and colleagues identified five identities: Apothecary, Dispenser, Merchandiser, Expert Advisor, Healthcare Provider.[2] All too often I have encountered use of these identities to define who I am and those in our profession. Some of these characterizations resonate well with me while others like pill-pusher I loathe. I am reminded of individuals like Andrew Craigie, America's First Apothecary General who defined the role of the pharmacist as one whose responsibility is "to receive, prepare, and deliver medicines". Community pharmacist and professionalism advocate, J. Leon Lascoff who wrote about being "pharmacy-minded" and fill the role as a man of science. "Pharmacy's First Lady" and advocate for women and minorities, Gloria Francke describing our role as not being dominated by sex or race but a commitment to serve at the highest level. These heroes of pharmacy had a clear identity of who they were as well as those they influenced. Their

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Meet the Editors

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Thank you ...
The Editors would like to thank the volunteers who performed the peer reviews and editing for this issue.

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Message from the Editor

Welcome

We are pleased to present the 13th issue of the History of Pharmacy SIG Newsletter *Pharmacy Chronicles: Past, Present, and Future.* This is also our second issue for this year, and our third year of providing two issues per year thanks largely to the interest of our readers and to the authors who labor for the benefit of our readers. We must give a big 'shout-out' to our peer reviewers who respond quickly and with constructive comments to the authors, resulting in a higher quality publication. We always welcome volunteers to be peer reviewers; we appreciate your efforts and the burden is light.

Of course, the peer-reviewers must have something to read, so we also gratefully acknowledge the authors who have taken the time to provide insightful and interesting stories that clear away some of the obscurity of our professional history. To further that endeavor, we encourage our readers to enlist the aid of your students to add to our pages. As many of our readers are teachers of pharmacy in so many disciplines, please take a moment as you organize your courses and lectures to incorporate some historical facts or context.

Speaking of obscure, the articles appearing in this issue bring to our

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ANNOUNCEMENTS

Welcome Message…

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identities might align with the historical characterizations, but I contend it was the attributes of professionalism that had a large impact on their own identities.

So, who are we? As a group with an interest in pharmacy history we can convey to students not just pharmacy related historical facts, but also the values and professional attributes of our own heroes of pharmacy. Highlight their contributions as well as how they define a pharmacist's identity. Many of you have storied careers with varied titles and roles. Likely you too have contemplated on your professional identity. It maybe one of those historical characterizations or even something else. Who in the past or present influenced your identity? Share your story and the identity that has led you. We can be an inspiration to others.

I am excited to serve as your chair this year. Along with the SIG officers I plan to continue initiatives that lead to achieving our strategic goals. Webinars are scheduled for the fall and spring along with a presentation proposal for the annual AACP meeting on the history of the pharmacists' professional identity. I welcome your thoughts or comments on the activities the SIG can do this year. Let us be a viable group with a clear identity of providing a sense of worth and purpose.

Sincerely,
Scott Wisneski, SIG Chair

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1. Elvey R, Hassell K, Hall J. Who do you think you are? Pharmacists' perceptions of their professional identity. Int J Pharm Pract. 2013; 21:322-332.

2. Kellar J, Paradis E, Cees PM., et al. A historical discourse analysis of pharmacist identity in pharmacy education. Am J Pharm Educ. 2020; 84(9) Article 7864.

RECOGNIZE YOUR STUDENTS FOR THEIR ACTIVITIES RELATING TO THE HISTORY OF PHARMACY!

The American Institute of the History of Pharmacy offers certificates to students to recognize their achievements in the area of History of Pharmacy. Nominate deserving students at the link below. The certificates could be sent directly to the students or to the schools for presentation at an awards ceremony.

Link: #AIHP/ Student recognition certificate

Editor Message…

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attention historically and geographically diverse topics that span from pre-history (mortar and pestle) to the ancient, a Chinese emperor founder of traditional Chinese medicine), to relatively modern (NIH beginnings) to a relatively recent tragedy (Tylenol/cyanide incident) among other articles.

We welcome a short, newsy piece of trivia or a full article for peer review (1500-2000 words). Pictures are always good! To volunteer, contribute as author or peer reviewer or just have a question, please feel free to contact either Cathy Taglieri or Bernie Olin. We are always happy to hear from you.

—Bernie Olin, PharmD.,
Auburn University,
Harrison College of Pharmacy

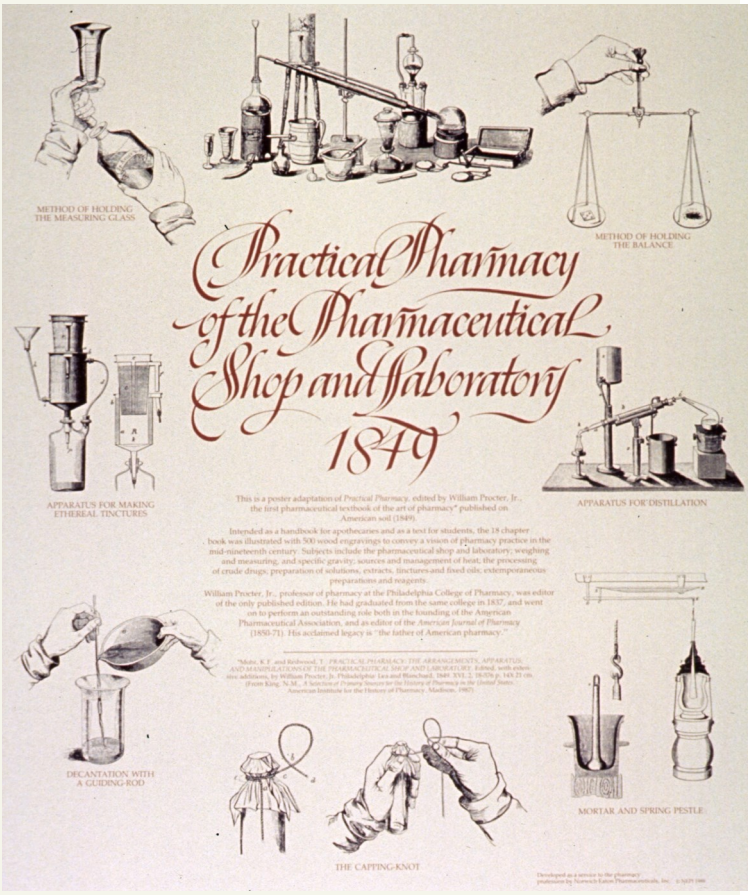


Image submitted by Dr. Heidi Mansour. A framed historic pharmacy artwork that was gifted to Dr. Mansour by 2 PharmD student researchers. The text explains the images and it's historical source from 1849. It is on display in her lab office.

American Institute of the History of Pharmacy Update

Greetings from the American Institute of the History of Pharmacy! Here is a summary of recent activities and developments at the Institute:

AIHP Board of Directors Election: AIHP members shortly will have the opportunity to vote (digitally) to fill vacancies on the Institute's Board of Directors. Past AACP President Cynthia Boyle, PharmD, FAPhA, AIHP's current Vice President, has been nominated to serve a three-year term as Vice President.

To fill the elected director position being vacated by Arthur Daemmrich, PhD, Institute members will choose between Terri Smith Moore, PhD, MBA, RPh, CPH, and Patricia C. Kienle, MPA, BCSCP, FASHP. Dr. Moore is the Senior Director of Academic Services and Strategic Initiatives at AACP. Ms. Kienle is the Director of Accreditation and Medication Safety for Cardinal Health Innovative Delivery Solutions.

Click here for more information about the nominees and the election.

AIHP Adopts a Diversity, Equity, and Inclusions (DEI) Values Statement: AIHP has adopted a DEI Values Statement to express its commitment to DEI principles and practices. Click here to read the statement. AIHP in 2021 made integrating and promoting DEI in all aspects of its programs and operations one of its strategic priorities during the next three years. Adoption of a values statement is one of several DEI-related action items called for by the Institute's strategic priorities implementation plan.

AIHP Bestows 2022 Awards for Contributions to Pharmacy History: The Institute recently awarded the 2022 Edward Kremers Award to Paula S. De Vos, Ph.D. for her book, *Compound Remedies: Galenic Pharmacy from the Ancient Mediterranean to New Spain* (University of Pittsburgh Press, 2020). AIHP awards the Edward Kremers Award to recognize the author(s) of a recently published book in the field of pharmacy history that exhibits high standards of scholarship, superior quality, and distinguished merit.

The Institute awarded the 2022 AIHP Robert P. Fischelis Award to Michael Harris for his extraordinary contributions to the Institute and the field of pharmacy history. Mr. Harris, a former AIHP president, served for 26 years as the Senior Museum Specialist for pharmacy and public health at the Smithsonian Institution's National Museum of American History, where he is credited with collecting objects and materials that illustrated pharmacy care in the U.S.

AIHP awarded three Certificates of Commendation in 2022. Carl Buckner was recognized for his collection of published writings on the history of pharmacy in Oklahoma. Stephen Hall was recognized for his work at the Coit Museum of Pharmacy & Health Sciences at the University of Arizona College of Pharmacy, where he served as Curator and Director during the museum recent renovation and expansion. The Pharmaceutical Heritage Centre, in Punjab, India, was recognized for its work to preserve and showcase the history of pharmaceuticals and medicines in India.

Tribute to Pharmacists Killed in World War II: A new resource on AIHP's website honors the 165 American pharmacists and pharmacy students who were killed in action, or died while on active duty, during World War II. The resource, a directory titled *We Remember Them: Pharmacy's Fallen* (accessible at this link), identifies and provides a brief biography of each man. This tribute to fallen pharmacists is the product of years of painstaking research by longtime AIHP member Dennis B. Worthen, PhD. Click here for more information about the tribute to fallen pharmacists.

AIHP's Trade Catalog Collection now Digitally Accessible: Selections from AIHP's Trade Catalog Collection have been digitized and are now available (here) through the University of Wisconsin Digitized Collections Center (UWDCC). The nearly 500 pharmaceutical trade catalogs in the collection, dating from 1829 to 2000, provide a picture into the stock of American drug stores of the period. Over the next several years, UWDCC will complete digitization of the entire trade catalog collection, as well as a significant portion of AIHP pharmacy photo collection.

AIHP Executive Director Announces Plans to Retire in 2023: Dennis Birke, the Institute's Executive Director since 2019, recently advised AIHP's Board of Directors of his intention to retire in 2023. The Institute expects to begin the search for his replacement in early 2023.

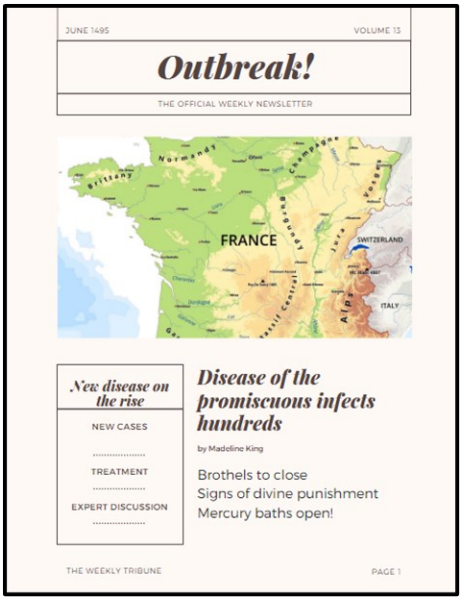
Clinical Pearl — Teaching the History of Pharmacy

Teaching history through an infectious diseases course

By Madeline King and Brandon Garcia

Philadelphia College of Pharmacy at St. Joseph's University has a modular style curriculum for the Doctor of Pharmacy program, so students have short, intense blocks where they learn pharmacology, pathophysiology and therapeutics of disease states associated with one body system. We have 3 infectious diseases (ID) modules, each approximately 3 weeks. Our third module, which is taught in the spring of the third professional year, focuses on topics that correlate well with public health, such as HIV, sexually transmitted infections, parasitic infections, and vaccines. For the first time, in Spring 2022, we incorporated the history of public health and ID into the module via several activities.

In the first week of the module, students were given an introduction to public health and then had to complete a team-based activity on epidemics and outbreaks in history. Each group of 4 students was given a "newspaper headline" leading them to the disease they needed to further research. [Example 1] The context in the newspaper headline directed them to the location and year of the outbreak, and listed symptoms related to the disease we wanted them to identify. The instructions were as follows: "You will be researching a historical epidemic, outbreak, or a disease that may or may not still be endemic somewhere on the globe. Your goal is to understand the disease itself, its relevance to history, and how it affects us today (if at all). You will create a twitter thread (at least 9 posts) about what you learn." Twitter thread posts were evaluated for: Accuracy, Completeness, Design (with at least 3 graphics accompanying the thread).



Example 1. Public health activity

The second week, the students worked in their groups to research an agent that could be used in biowarfare, such as anthrax. [Example 2] They had to research any historical uses or attempts of its use as an agent of biological warfare, and explain how it might be used in an attack today. The students also indicated the pharmacist's role in an emergency response scenario involving their assigned agent. The assignment was to present the information as though they were informing the public (e.g. news/radio broadcast or a podcast), and create a supporting visual.

Example 2. Bioterrorism assignment

This course served as the first exposure students had to the history of public health and ID. In addition to the above-mentioned as

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Teaching history through an ID course...

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assignments, students were encouraged to listen to "This Podcast Will Kill You" episodes for extra credit. The podcast is about a different infectious disease each week, and they explore the biology, ecology, and history of the pathogen, as well as describe past epidemics. It is crucial that we introduce students of health professions to health history so they gain new insight and perspective into the diseases they'll manage. It will also prepare them to avoid repeating the same mistakes we have made in past public health crises. Student feedback regarding the activity is shown in Figure 1 (below).

—Madeline King, PharmD. Co-director Outpatient Anti-Microbial Stewardship, Cooper University Healthcare, and Brandon Garcia, PharmD., Assistant Professor of Clinical Pharmacy Saint Joseph's University, Philadelphia College of Pharmacy

Innovative ways to include history of pharmacy in Pharmaceutics, PharmD/ graduate/undergraduate courses

On World Pharmacists Day (Sept 25), American Pharmacist Month (October), and Women Pharmacist Day (Oct 12), I start the first 10 minutes of the lecture on history of pharmacy tidbits with slides/pictures. Also, before starting a lecture on certain delivery system e.g. pulmonary inhalation aerosols, nasal inhalers, vaccines, I start each lecture with the history of the dosage form/ delivery system with pictures.

—Heidi M. Mansour Ph.D., R.Ph. Professor, Florida International University

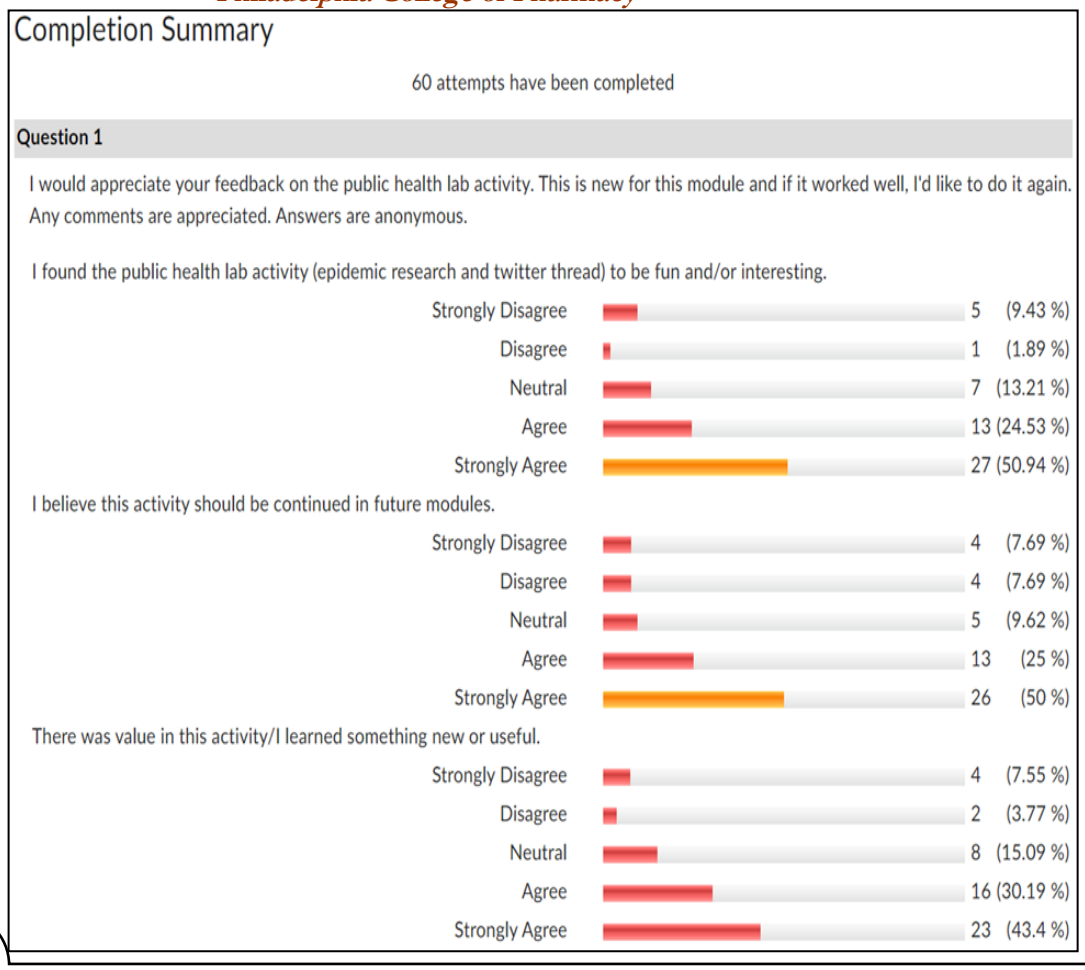

Figure 1. Student feedback

Clinical Pearl — Teaching the History of Pharmacy

How to incorporate history of pharmacy into advanced rotations: Fun Facts and Fun Puns-

By Melinda J. Burnworth with examples from APPE students

A consistent observation made over two decades of teaching hospital pharmacy practice, is that most learners have an innate interest in history, the curiosity about what happened before. For a modern example, reflect on teaching and learning styles pre-pandemic (in person), during (virtual), and after (endemic hybrid). Bridging this to pharmacy, how can preceptors (new or seasoned) take the extra effort to arouse that inquisitive nature in students, to pique interest in learning more about a medication's historical development? How can the preceptor bridge the history of a drug's development to the modern pharmacist?

First, the preceptor can show individual excitement and genuine interest in a specific drug's development to stimulate the learner's curiosity in the history of the drug. Tried and true examples include 1) **metformin**, originally studied as a treatment for malaria, now used in maturity-onset diabetes (type 2 diabetes mellitus); 2) **warfarin**, origins from clover, cattle, and coumarin, the name derived from WARF (Wisconsin Alumni Research Foundation) and –arin from coumarin. Second, once the student's interest is piqued, encourage the initial investigation of the drug's history via the worldwide web as the modern search engine (the results may very well shock the learner). Balance this search with a more medically focused search in a reputable pharmacy or medical journal. Finally, encourage the learner to summarize the "fun fact" and "fun pun" as a creative written assignment. These intriguing drug history pearls can be used as teaching tools for future learners.

In conclusion, preceptors are encouraged to share in the preservation of a drug's development heritage by incorporating a similar activity into their learning experiences. To get started, consider this generic template.

Fun Fact [assigned by the preceptor]:
Fun Pun [created by the learner]:
Prepared by [learner]:
Answer [researched by the learner and edited by the preceptor]:
Reference [use preferred citation format]:

Preceptors may also pique the learner's interest by sharing the following "Fun Puns" recently completed by students during the acute care/ hospital rotation (advanced pharmacy practice experience).

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Fun Fact #1: The drug name **"cisplatin"** is derived from what?
Fun Pun: Metals, Microbes, and Malignancies, Oh My!

Prepared by: Breanne Boyette, Doctor of Pharmacy Candidate, Class of 2023, Midwestern University College of Pharmacy, Glendale Campus, Arizona
Answer: Cisplatin was first described in 1845 by Italian chemist Michele Peyrone. This compound, *cis*-[Pt (NH3)2CI2], became known as "Peyrone's chloride." In 1965, American chemist Barnett Rosenberg utilized platinum (Pt)-based electrical fields during experiments with *Escherichia coli* to understand whether electrical fields affected microbial growth. Rosenberg's team found that *when the electrodes were turned on, the* cell division of *E. Coli* stopped. Once the electrodes were turned off, cell division began again. Upon further research, the team discovered, that the electrical current was not the cause of the halted cell division, but rather, the Pt compound. Rosenberg et al then tested whether the Pt would stop cell division in tumor cells by utilizing the compound in mouse models with sarcomas. These trials revealed that Pt had the potential to shrink tumors. Despite concerns regarding placing heavy metals in the body, clinical trials on humans began in 1972. In 1978, the Food and Drug Administration approved cisplatin for use in testicular, advanced ovarian, and bladder cancers. The drug name

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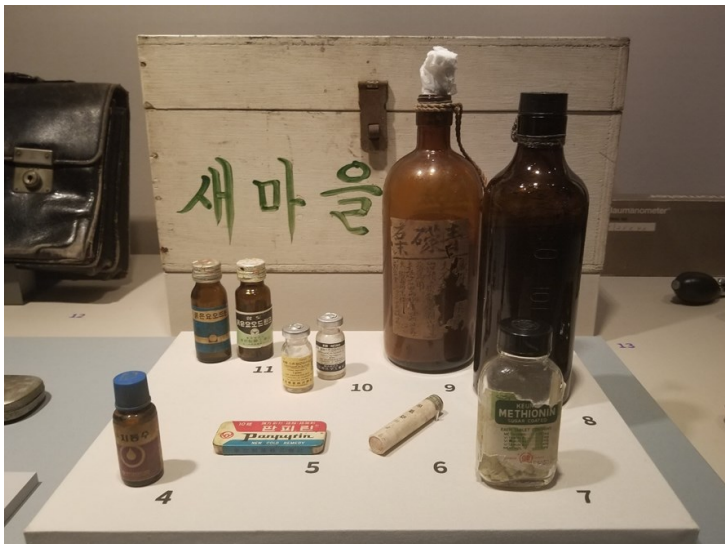
A visit to a Korean Pharmacy Museum

By Joseph Cusimano

In August, my wife and I had the pleasure of traveling to South Korea for our honeymoon. While visiting, we explored the National Folk Museum of Korea, where I was excited to find some historical pharmaceutical preparations. The image below was taken from one exhibit.



Please see below for a reproduction of the exhibit labeling with commentary:

4: "Toothache pain relief elixir," 1986[1]

5: "Panpyrin, a fever reducer," 1970s[1]

According to the manufacturer of Panpyrin®, Dong-A Pharm. Co., it is the best-selling cold medicine in Korea.[2] Panpyrin® contains three medicines (acetaminophen 300 mg, chlorpheniramine maleate 2mg, and anhydrous caffeine 30mg).[2]

6: "Medicine bottle for storing medication for influenza," early 20th century[1]

7: "A bottle containing methionine, an essential amino acid, including sulfur," after mid-20th century[1]

8: "Ssanghwatang, traditional herbal formula, brewed to tea-like medicine, assists in fatigue recovery by harmonizing the pathway between blood and energy," after mid-20th century[1]

Ssanghwatang (쌍화탕) is an herbal mixture composed of Chinese peony (*Paeonia lactiflora*), Rehmanniae Radix, *Astragalus propinquus*, Chinese cinnamon (*Cinnamomum cassia*), *Angelica gigas*, cnidium (also called Cnidii Rhizoma, *Cnidium monnieri*), and Chinese liquorice (*Glycyrrhiza uralensis*).[3] The exact herbal composition may vary by the source.[4]

9: "A bottle containing medicinal ingredients called cheongmongseok, a type of expectorant used to dilute sputums symptoms [sic] such as gallbladder, epilepsy, convulsions, cramps, etc.," after mid-20th century[1]

Cheongmongseok (청몽석) is "lapis chloriti", or 青礞石 (qīng méng shí, or "green stone") in Chinese. It is used for a variety of purposes in Traditional Chinese Medicine, including those noted above.[5]

10: "Medicine bottle for streptomycin, a tuberculostatic, as well as an antibiotic medication," around 1970[1]

11: "Mild iodine tincture, used as a skin disinfectant," 1970-80s[1]

The exhibit featured a number of other interesting pieces as well, including a medical prescription and book of medicinal recipes dating to the late Joseon dynasty. It was interesting to note the parallel use of both single chemical entities and herbal concoctions during late 20th century Korea; a pattern that continues today and is not too dissimilar from the medication-taking habits of 21st century American consumers.

—Joseph Cusimano, PharmD, BCPS,
Assistant Professor of Pharmacy,
Bernard J. Dunn School of Pharmacy,
Shenandoah University

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Clinical Pearl; Fun Pun...

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"cisplatin" was derived from the *cis* form of the Pt salt used in the Rosenberg experiments. To this day, cisplatin is a widely utilized chemotherapy agent, and has become part of the "backbone of chemotherapy combination treatments."

References for Fun Fact #1:

Rosenberg B, Van Camp L, Grimley EB, Thomson AJ. The inhibition of growth or cell division in Escherichia coli by different ionic species of platinum (IV) complexes. *J Biol Chem.* 1967;242(6):1347-1352.

National Cancer Institute. The Accidental Cure—Platinum-based Treatment for Cancer: The Discovery of Cisplatin. National Institutes of Health. https://www.cancer.gov/research/progress/discovery/cisplatin. Published May 30, 2014. Accessed September 8, 2022.

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Fun Fact #2: Who invented **aspirin** and **heroin**?

Fun Pun: Don't contemplate, acetylate!

Prepared by: Luis Mejia, Doctor of Pharmacy Candidate, Class of 2023, Midwestern University College of Pharmacy, Glendale Campus, Arizona

Answer: How can a single parent compound both prevent cardiovascular disease and cause cardiovascular complications? The answer is derived from how the parent compound is acetylated into various metabolites. To this point, salicylic acid is derived from willow bark and was discovered in the 19th century. While chemists were able to synthesize the chemical, the raw form came with unwanted side effects and many patients were not able to tolerate the newly discovered chemical. Felix Hoffmann, a German chemist, was able to acetylate the base salicylic acid to a more pure and stable form, acetylsalicylic acid. This form is now known as aspirin. In fact, the name "aspirin" is derived from the "a" in acetyl and "spirin" (like willow bark, *Spirea* is another shrub that produces salicylic acid). The pharmaceutical company, Bayer AG, tested this new product for toxicity and soon thereafter applied for a patent in Germany; the patent was rejected. Consequently, Bayer AG applied for a patent in the United States whereby the drug was approved and became available over the counter (OTC) to promote blood flow to the heart and provide analgesia. Upon successfully acetylating salicylic acid, Hoffman was tasked with acetylating morphine to theoretically produce codeine (for cough suppression). Instead, the chemist produced the compound diamorphine. The acetylated diamorphine turned out to be a more potent analgesic than morphine and was named heroin. Initially the drug was sold OTC and was used to relieve pain from labor and injuries, and treat cough related to tuberculosis. By early 1930, heroin was banned due to its extreme addictiveness (let alone potential for causing heart attacks).

Reference for Fun Fact #2:

Domenech F. Felix Hoffmann, the man who invented aspirin and heroin. OpenMind BBVA. https://www.bbvaopenmind.com/en/science/scientific-insights/felix-hoffmann-the-man-who-invented-aspirin-and-heroin/. Published February 10, 2021. Accessed August 26, 2022.

Science History Institute. Felix Hoffmann. Science History Institute. https://www.sciencehistory.org/historical-profile/felix-hoffmann. Published December 8, 2017. Accessed August 26, 2022.

—Melinda J. Burnworth, PharmD, FASHP, FAzPA, BCPS; Professor of Pharmacy Practice, Midwestern University College of Pharmacy, Glendale Campus, Arizona

A Visit to a Korean Pharmacy Museum

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3. Park SJ, Kim MO, Kim JH, et al. Antioxidant Activities of Functional Beverage Concentrates Containing Herbal Medicine Extracts. Prev Nutr Food Sci. 2017;22(1):16-20. doi: 10.3746/pnf.2017.22.1.16.

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5. "青礞石 Qingmengshi." Chinese Medicinal Material Images Database. 2022. URL: https://sys01.lib.hkbu.edu.hk/cmed/mmid/detail.php?pid=B00405. Accessed October 11, 2022.

Advertisements through history

The Legend and Legacy of the Father of Traditional Chinese Medicine, Shennong (神農)

By Kitt Lee and David M. Baker

Shennong (神農), or Shen Nung, is one of the most well-known Emperors of ancient China.[1] He lived during the Era of Legends (around 2700 B.C.) period, when history was passed on through tales, since written language did not yet exist.[2] He is credited with many important societal contributions, such as controlling fire, improving agriculture, inventing musical instruments, and developing pottery, all of which improved his clan's living conditions.[1-7] His discoveries in the field of medicine commenced the discipline of traditional Chinese medicine.[1-7] Despite the passage of thousands of years, his legend lives on and his teachings still have an influence in modern-day Chinese medicine.[8] This paper will attempt to separate the legend from the facts concerning the life and accomplishments of Shennong.

The Legend:

According to legend, Shennong's mother, Nudeng (女登), was the wife of Shaodian (少典), tribal leader of the Jiang clan, and the daughter of the creator of humankind, Nuwa (女媧).[1,3,5,6,9] During a trip she took along the Yellow River, she was blessed (i.e., impregnated) by a dragon, after which she gave birth to Shennong (神農).[1,3,5,6] Shennong was born a god, with a pair of horns, starting to talk when only 70-days old.[1,3,6,8,10]

It was a time when there were few people, but plenty of animals.[11] The Jiang (姜) clan was a group of fishermen and hunters who collected and ate wild grass, fruits, animals, clams, and unfortunately, like many of that time, drank unclean water.[4,12] Consuming unclean water and raw meat often brought illness to the clan members.[4,5,11,12] To solve the problems of an unstable food supply and a continuously growing population, Shennong, their clan leader, sought clean water, invented plowing tools, created pottery containers, and taught his people farming.[1,4,6,7,11,13] Inventing agricultural methods resulted in him being crowned the God of Agriculture, and his name, Shennong, is translated as "Divine Farmer."[1,4,11,13] His creativity in controlling fire, using it to clear land for crop planting, instead of scavenging, resulted in his designation as the Emperor of Flame.[1-7,11,12] His development of agriculture resulted in surplus food, so Shennong invented barter, allowing people to bargain to meet their other needs.[1,5-7,11]

There are no statues or paintings extant from Shennong's lifetime. This is a famous statue of Shennong, the "Divine Farmer," that is at the base of Shennong Mountain which lies in the northwest of Qinyang, Henan, China. [14]

Shennong is known for eight important contributions: inventing farming tools and agricultural methods; testing hundreds of herbs and developing herbal medicines; creating market centers for bartering; inventing sewing methods and creating clothes; inventing musical instruments, like the Shennong Qin (神農琴); inventing bows

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Parrot Fever and the Birth of the NIH

By Karen Nagel Edwards

Pandemics have become everyday conversation over the past few years, with COVID-19 masking and quarantining bringing up comparisons to the 1918-19 influenza pandemic. However, a little-known outbreak in 1929-30 can be credited with the beginnings of the now highly influential National Institutes of Health (NIH). The pandemic? Parrot Fever, more formally known as psittacosis. (1, 2)

What most of us remember about parrot fever from pharmacy education is probably minimal. It is caused by Chlamydia psittaci and is transmitted to humans predominantly by birds. As the colloquial name would suggest, most infections are traced to contact with birds from the order Psittaciformes, which includes parrots (Figure 1), parakeets, cockatiels, and cockatoos. Migratory birds such as geese, and domestic birds such as chickens and turkeys may also be reservoirs. Certain strains may affect other animal species ranging from cats and dogs to sheep, goats, dairy cattle and horses, but human infection is primarily linked to inhalation of organisms in dried feces or from mouth to beak contact with pet birds. The incubation period is typically 5-14 days. While infection in humans may be asymptomatic, it most commonly presents with fever, dry cough and a pronounced headache, often with sensitivity to light. Rigors, sweats and myalgias also occur in most patients. Today, diagnosis can be rapidly confirmed with polymerase chain reaction (PCR) methods, and treatments have been available for decades. Tetracyclines (doxycycline or tetracycline hydrochloride) are the drugs of choice, with macrolides (erythromycin or azithromycin) being second-line therapy. (3).

Knowledge about psittacosis at the time of the 1929-1930 pandemic was notably less than what is understood now. While psittacosis itself was first described in the 1880s, outbreaks prior to 1929 remained relatively small and the causative agent had not yet been discovered. Antibiotics were not available; sulfonamides were not marketed until the 1930s, followed by penicillin the following decade. Antibiotics effective against the disease weren't available until the 1950s, long after the pandemic had passed.

Figure 1: Macaw parrot. Source: Andre Chivinski / Creative Commons / Public Domain.

In December 1929, Simon Martin purchased a parrot in Baltimore as a surprise Christmas gift for his wife. The parrot stayed with Martin's daughter and son-in-law for the 10 days leading up to the holiday, but it was noticeably ill by Christmas Eve and dead by morning. By January 6, 1930, Martin's wife Lillian, daughter Edith and son-in-law Lee Kalmey were all extremely ill. Dr. Willis P. Martin suspected pneumonia or typhoid fever, but the symptoms didn't quite fit. The parrot connection was only identified after the doctor mentioned the dead parrot to his wife. She had recently read a newspaper report about an outbreak of Parrot Fever that had decimated a theatrical troupe in Buenos Aires, Argentina. The troop had included a live parrot that numerous members interacted with on stage. Two troop members and the parrot had died, and many others were sick. Argentinians were being warned to report sickly pet birds to the authorities. (1, 2, 4, 5)

Dr. Martin contacted the Public Health Service (PHS) in Washington, DC by telegram, requesting parrot fever serum, which did not exist, and information. The PHS started receiving telegrams from other states about similar illnesses. The PHS director, Surgeon General Hugh S. Cummings, passed the communications along to Dr. George W. McCoy, director of the PHS' Hygienic Laboratory. McCoy's credentials were impeccable, as he had discovered the causative agent for tularemia and had been part of bubonic plague investigations in San Francisco. McCoy and his deputy Charlie Armstrong initially

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Tylenol and Cyanide: Genesis of the 1983 Federal Anti-Tampering Act

By Ken Skau and Michael Hegener

In September and October of 1982 Americans witnessed a near panic. In the greater Chicago area seven people died of cyanide poisoning that was eventually linked to cyanide laced Extra Strength Tylenol Capsules. Although the number of people that died was relatively small, authorities recognized the potential for a catastrophe and acted quickly to change the way over-the-counter drugs (and subsequently food and cosmetics) are marketed.

Mary Kellerman (12 years old) of Elk Grove Village, Illinois, woke early on the morning of September 29, 1982 with symptoms of a cold. Her parents gave her an Extra Strength Tylenol capsule and sent her back to bed. By 7:00 am Mary was dying on the bathroom floor. Adam Janus (27 years old) of Arlington Heights, Illinois, experienced some minor chest pain that same morning and took Extra Strength Tylenol to relieve the pain. An hour later he experienced cardiopulmonary collapse and died suddenly. That evening, as his family and friends gathered at his house to mourn his death, Adam's brother Stanley (25 years old) and Stanley's wife Theresa (19 years old) developed headaches and took Extra Strength Tylenol from the same bottle that Adam had used. Stanley died that night; Theresa lingered for 2 days before expiring. Mary Reiner (27 years old) of Winfield, Illinois, had recently given birth to her fourth child. On September 30 she took 2 Tylenol capsules for a headache. She was dead at the local hospital within a few hours. The same day Mary McFarland (31 years old) collapsed at work and died. Paula Prince (35 years old), a flight attendant, was found dead in her Chicago apartment on October 1st.

Initially these deaths were not linked, as the cause was not clearly determined. Dr. Thomas Kim at Northwest Community Hospital recognized the unusual circumstances of the Janus family members' deaths and contacted Dr. John Sullivan Jr. at the Rocky Mountain Poison Center. Based on the symptoms Dr. Sullivan suggested that perhaps the victims suffered cyanide poisoning. As it became evident that all 7 victims had died of cyanide poisoning the citizens of Chicago, and the nation as a whole, realized with horror that someone had poisoned these people. However, the common link to how the poison was administered was not yet known. Two off duty Chicago firemen, Philip Cappitelli and Richard Keyworth, who heard the reports noted that Tylenol was mentioned in two of the reports and suggested to their superiors that perhaps the Tylenol was the source of the poison. The homes of the victims were searched, and bottles of Tylenol were analyzed. Each bottle contained capsules laced with about 65 mg of potassium cyanide. Reports in the media stated that the median lethal dose of potassium cyanide was about 5-7 mcg, but this is an exaggeration. Lethal blood levels are estimated to be about 1 mcg/ml indicating that lethal doses are higher than those reported. The lethal dose of this poison in an adult is between 60-90 mg.

Cyanide is a rapidly acting, but often painful, poison. The substance irreversibly inhibits major metabolic enzymes in cells by disrupting the electron transport chain, oxidative phosphorylation, and oxidative metabolism. Cyanide produces an almond-like odor in the victim's breath, vomit, and body fluids. However, 20-40% of the population cannot detect the odor. Death occurs often within minutes of ingesting the poison.

Authorities acted quickly and were able to trace the purchase of the poisoned product to 4 Chicago-area stores including a Jewel Foods, an Osco Drug, and a Walgreen Drug store. Lot numbers of the tainted products were identified but it was not yet certain where and when the contamination occurred. Some additional bottles of contaminated capsules were found, unsold, during the recall. The Chicago mayor (Jane Byrne) banned the sale of Tylenol products and volunteers canvassed the city to warn the public about the danger. The FDA advised all consumers to avoid Tylenol products. Chicago police drove up and down city streets broadcasting over loudspeakers the caution about using Tylenol products.

The maker of Tylenol, Johnson and Johnson, faced a crisis. Tylenol was their major product and accounted for a significant percent of their profits. How were they to deal

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Mortar and Pestle: A Symbol of Pharmacy

By Diyaben S. Patel and Jane E. Krause

Discovery and Description

Mortars and pestles hold a place of honor as the most distinctive tool and symbol of the profession of pharmacy.[1,2,3,4] The mortar and pestle, is perhaps the oldest of all pharmaceutical equipment. They were probably the earliest implements used in the practice of pharmacy and medicine and in the preparation of food by primitive man. It is believed that mortars and pestles started as a big hollow in a rock.[2,5]

Ohlone Stone Mortar and Pestle, made between 6000 B.C. and 1800 A.D..[13]

The first written mention of a mortar and pestle is found in early writings: such as the Egyptian "Papyrus Ebers", the oldest discovered medical knowledge book dating to 1550 B.C., and in the Old Testament of the Bible, verses Numbers 11:8 and Proverbs 27:22.[1,2,5,6] However, it is estimated that mortars and pestles were used for hundreds, if not thousands of years before this for the grinding of spices, cosmetics, and dyes.[2,7,8] Ancient Greeks and Romans used mortars and pestles for preparing food.[8] Long before food-processors and blenders, the mortar and pestle served as the food processor in the ancient kitchen. It is interesting to note that mortars and pestles are unique in that their design has largely remained unchanged over time.[7] They are likely one of the few inventions of early man which has truly stood the test of time.[8]

Over time, every pharmacy had at least one mortar and pestle for grinding, pulverizing, and mixing drugs.[9] The English word "Mortar" derives from the Old French "mortier" and Classical Latin "mortarium" which refers to a vessel in which substances are mixed, ground or pounded.[1,6] The English word "pestle" can be traced back to the thirteenth-century Old French "pestel", from the Latin "pistillum", for pounder, which derived from "pinsere", to pound or crush.

Evolvement of Mortars and Pestles

Early pharmacies usually had one very large mortar made of bell metal/ bronze, an alloy consisting primarily of copper and tin.[2,9] These heavy and highly ornamented bell metal mortars were made as early as the 12th century.[9] They often weighed 100 pounds or more and were placed in the pharmacy on a large section of a tree trunk, with the pestle suspended from a chain overhead.[2,9] Bell metal mortars were cast in foundries alongside bells for monasteries and churches.[2,3] These mortars were often highly decorated with popular designs of the period and country of origin, such as cherubs, foliage, masks, figures, shells, and Tudor roses.[2,3,9] Some mortars also had wording commemorating an event or recording the maker or owner of the mortar.[2]

Bell Metal/ Bronze Mortar decorated with centaurs, made in Europe between 1671-1730.[14]

By the end of the eighteenth century, pharmacists questioned the wisdom of using bell metal and also brass mortars and pestles because of the tiny flakes of metal produced by constant friction between the mortar and pestle which could contaminate the contents.[9] During this time, pharma-

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Bezoars – Miraculous Panaceas of the Past

By Liz Remizowsk and Michael Hegener

Bezoars have long been a centerpiece in Western monarchs' treasuries, valued for their exotic origins and mystical healing powers. Royalty presented them as gifts alongside diamonds, pearls, emeralds, and other rare gems. The bezoars themselves were set in elegant gold or silver filigree, decorated with precious stones, and presented in ornate gold boxes.[1] Queen Elizabeth I had one set in a ring, and her beige gowns were described as "Besear colour".[2] But what are bezoars, and how did they attain this status of miraculous panacea more valuable than diamonds?

Bezoars are stone-like formations around undigestible material in the stomachs of ruminant animals such as goats, sheep, antelope, and cattle.[3] They are variously composed of animal hairs, vegetable fibers, ellagic acid, and mineral concretions. Sizes range from barley grains to truly enormous – one was measured at forty inches in circumference. Their many layers are often likened to an onion.[4] They appear in many colors from milky to red to black and can be rough or smooth textured.[5] Highly valuable bezoars came from Persia, China, India and the New World, and host animals ranged from goats and cows to monkeys and porcupines.[6]

The term "bezoar" comes from the Persian "padzahr" – pad, expelling; zahr, poison.[3] Bezoars were potentially known to the ancient Hebrews,[6] and references in Arabic medical literature date back to the eighth century. Around 1000 CE, Abu al-Rayhan Muhammad ibn Ahmad al-Biruni, a Shiite Persian living in India, describes bezoars as decorative yet more precious than jewels due to their value as an antidote and talisman. The earliest accounts in European scientific literature date from around 1140 CE.[5] Bezoars made their way into Europe from Persia and India via Spanish contact with the Moors. Physicians started using them upon hearing rumors of these miraculous healing stones, desperate for a treatment for "pestilential fevers" racking Europe. By the end of the twelfth century, bezoar usage was common.[3] A New World source was discovered in Peru in 1571; bezoars from Andean camelids were highly prized by the local population as sacred objects, used in religious rituals for protection of the family and the tribe. These new "occidental" or western bezoars were exported to Europe and marketed as miracle cures alongside their Old-World counterparts. By the seventeenth and eighteenth centuries, New World bezoars were as valuable as Old-World bezoars.[1,7]

Originally imported as occult curiosities, increasing bezoar availability allowed for exploration of their properties, both medicinal and mystical, further increasing their value. Bezoars were particularly acclaimed as an antidote: because poisons were considered otherworldly, their antidotes must be similarly occult, and greater exoticism imparts greater healing powers.[8] Bezoar formation legends support their status: in one popular tale, a stag searches for and consumes venomous serpents, then submerges himself in a river up to his head. The stag's tears leech out the serpents' venom, ulti-

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Pictured left, an image of a Bezoar stone

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and arrows; creating pottery and the axe; and designing houses.[1,4,6,11,13] Legend has it that Shennong patched the sky, melted the sun, extended the universe, tested hundreds of herbs, and ended epidemics.[9] Shennong is considered the ancestor and originator of Chinese culture, and his inventions gave rise to a Chinese civilization that has lasted for thousands of years.[7,12]

To examine herbs, Shennong allegedly used a red whip called Shebien (赭鞭).[1,9,10,13] Shebien is a Chinese mythical treasure, since it could mysteriously reveal a plant's properties. Another legend is that he tested hundreds of herbs on himself, ingesting as many as 70 toxins a day.[4,5,9,10,13] He would drink tea as an antidote for the toxins he encountered, which practice spread the benefits of daily tea drinking.[6,13] In addition, by drinking only hot drinks, unclean water was purified by boiling. Medicinal herbs were not his only medical achievements, as Shennong also introduced the practice of candle rituals to develop personal focus, and developed several medical techniques, such as pulse diagnosis, acupuncture, and moxibustion.[1,12]

There are several versions about how Shennong discovered tea. One story version is that he used Shebien to reveal the medicinal property of tea. A more interesting version involves Shennong being born with a shiny and transparent stomach. Saddened by the deaths of people from the ingestion of bad food, Shennong began to test hundreds of herbs, observing what occurred in his stomach, and educating his people accordingly. One time, he ate some random leaves and noticed they detoxified his gut. He called the leaves 查 ("examination"). Later, others would mistakenly call the same leaves a different word having the same pronunciation: 茶 ("tea"). Shennong would continue to test herbs until he ate Gelsemium elegans, the poisonous plant which killed him before he could drink his tea.[9,13] Shennong allegedly died at the age of 120 years old.[1]

There are many mythical and interesting stories about Shennong. One story relates how Shennong discovered Trillium tschonoskii Maxim. According to the story, Shennong was picking herbs in deep woods when he was attacked by a den of snakes. Strangled and bitten by the snakes, he screamed for help. Hearing Shennong's cry, the Queen Mother of the West sent Jade Bird with celestial pills to save him. The venomous snakes scurried away when they saw the approach of the Queen Mother's ambassador. After being fed one of the pills, Shennong woke up. He thanked Jade Bird, but accidentally dropped one of the pills onto the ground. Immediately, a green bud sprouted out of the ground, a red bead grew out of the bud, and it looked just like a celestial pill. Shennong swallowed the red bead, which relieved all of his pain. He realized that he had discovered the cure for snake bite venom, naming it "bead on top of the head." Nowadays, the plant is called 延齡草 ("Grass that Prolongs Life") in Chinese or Trillium tschonoskii Maxim in Latin nomenclature.[5]

The Legacy:

Even after separating the facts from the legend, Shennong's life story is still exceptional. His mother, Nudeng, was traveling along the Yellow River when she had an affair, resulting in the conception of Shennong. Clearly his clan-leader father was convinced of Shennong's birthright, since he raised him as his son. Due to this upbringing, Shennong had the opportunity and time to develop his knowledge and leadership skills. His study of herbs improved his people's health and prolonged their lives. In collecting and studying herbs, he discovered the purpose of seeds, leading to the development of farming versus scavenging for food. Agriculture resulted in food surplus, which allowed time for the development of other achievements like inventing instruments and pottery, and mastering the control of fire. It is possible that he did not accomplish these alone, but all the credit went to Shennong, being the clan leader. In the end, he was poisoned by one of the very herbs he was testing, dying from ingestion of its toxins.[1]

Medical Discoveries

In the time before Shennong, the concept of medicinal properties in plants had yet to be discovered. Shennong tested many herbs in his lifetime by ingesting them, observing their properties, and determining their indications and directions (君臣佐使).[9,10] Below are the medicinal properties that he identified:

Jun (君) – the main therapeutic ingredient;

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Chen (臣) - a substance that aids or enhances the effects of the main therapeutic ingredient after complications arise;

Zuo (佐) - a substance that enhances the main therapeutic ingredient with or without complications, neutralizes or lessens the main therapeutic ingredient's side-effects, or is the opposite of the main therapeutic ingredient, yet develops the therapeutic effects of the main ingredient; and

Shi (使) - a substance used to deliver the drug to the target site, or to detoxify the body.

It is believed Shennong tested hundreds of herbs on himself. In the process, he ate DuanChang Cao (斷腸草 or Gelsemium elegans) on Mt. Yangtou, dying from its toxicity in Beiying Village (北營村).[10] Another version claims that he died in the city called Baoji (寶雞).[5] In both stories, the cause was DuanChang Cao, which means "grass that cuts intestines," the local name for a native southeast Asian plant with respiratory depressant activity.[9,10] Shennong was buried in Changsha, the current capital city of Hunan Province in China.[6]

Medical Literature

"Shennong Bencao Jing" ("Shennong Materia Medica"), although named for Shennong, was not written by him, although it is believed that the knowledge within was compiled by him and handed down by verbal tradition.[8] In reality, it was written by many different physicians during the Han dynasty (B.C. 202 - A.D. 200), summarizing the results of actual trials of the substances within.[8] It is the first medical literature in Chinese history.[8,12] The work consists of 3 volumes, containing 365 medicines, sourced from 252 plants, 67 animals, and 46 minerals.[5] The medicines are divided into upper, middle and lower grades.[8] It also summarized different dosage forms such as: Wan (丸) - a marble-shaped pill, San (散) - a powder, Tang (湯) - a decoction, Jiu (酒) – a topical alcohol, and Gao (膏) - a topical paste.[8] The work also proposed the idea of Qiqinghehe (七情合和), or combination therapy, defining the following:

Danxing (單行) - a drug that can be administered by itself effectively;

Xiangxu (相須) - combination therapy with two similar drugs;

Xiangshi (相使) - combination therapy with two distinctly different drugs;

Xiangwei (相畏) - using one drug to lessen the potency of another drug;

Xiangsha (相殺) - using one drug to mediate the toxicity of another drug;

Xiangwu (相惡) - combinations that render each drug useless; and

Xiangfan (相反) - combinations that induce toxicity.[12]

"Shennong Materia Medica" is the earliest medical text from China.[12] It introduced a systematic way to categorize herbs, and even thousands of years later, it still has influence in modern Chinese medicine.[12]

Summary:

The Yan Emperor or the Emperor of Flame, was and is an important historical figure from the Chinese Mythical Era, the time before written language was existent.[3] In that time period, stories were relayed from one generation to the next by word of mouth. The Emperor of Flame was head of an ancient tribe that existed for about 500 years.[3,10] According to historic records, the first Emperor of Flame and Shennong were not considered to be the same person until the Han dynasty (B.C. 202 - A.D. 200).[3] However, historical research now views them as the same, and it is very common to use the terms "the Emperor of Flame" and "Shennong" interchangeably.

After the Zhanguo Era (B.C. 475 - B.C. 221), legends of Shennong were inflated – everything from being the leader of a tribe that was experiencing a downfall to the inventor of traditional Chinese medicine.[3] The myths of Shennong originated in many regions of China, primarily

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around Mt. Yangtou (羊頭山) in the Shanxi (羊頭) province.[8] In the Shanxi province, people of the Jiang tribe and neighboring areas still preserve their tradition of worshipping sheep and goats.[8] This might explain why Shennong is thought to have been born with a pair of horns.

Interestingly, in Shanxi province farming tools have been found in archaeological sites dating back to 16,000 years ago.[8] This invalidates the stories of Shennong inventing agriculture, since he was later in time. However, with the deification of Shennong as the Emperor of Flame, becoming the God of the South who controls the summer, the myths surrounding him continued despite these contradictions.[3,7,13] Confucius commented that the idea of Shennong is flexible enough to suit different people at different times.[13] For example, the deification of Shennong was and is used to help contain people's fear of epidemics and famines.

The Emperor of Flame worship ceremony in Gaoping, Shanxi, celebrating Shennong's sacrificial act of finding cures.[15]

Today, the culture of worshipping Shennong is deeply rooted in the Shanxi area. Temples were built for Shennong, where people pay their respect to Shennong every year.[10] Although it might not be possible to verify the genuineness of these stories, it is certain that his name will be forever remembered and worshipped as the first Chinese herbalist, and originator of traditional Chinese medicine. He tested hundreds of herbs on himself, even at the risk of exposing himself to toxins. After thousands of years, stories about him are still told today, and his alleged contributions to traditional Chinese medicine continue to have a monumental influence in the development of Chinese medicine.

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knew nothing about parrot fever. As they set to work, it became clear the Hygienic Laboratory facilities were inadequate; McCoy and Armstrong had been lobbying the government for years for additional funding and better space. While the laboratory had increased in size on moving from Staten Island to Washington, DC in 1891, it was no longer enough (Figure 2). (1, 2, 3, 4, 6)

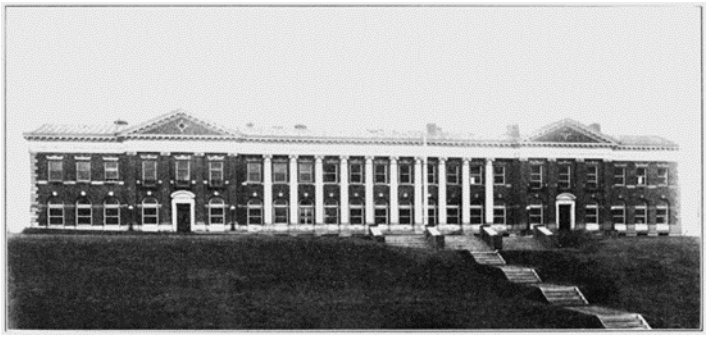

Figure 2: Hygienic lab of the US public health service in Washington DC. August 14, 1912. Source: Popular Science Monthly Volume 82 / Wikimedia Commons / Public Domain.

While McCoy and Armstrong's team investigated treatments, the press controlled public opinion. The "epidemic exposé" was extremely popular in science journalism of the day. Enter Paul de Kruif, a bacteriologist who pivoted to journalism after research and teaching posts at University of Michigan, the US Sanitary Corps, and the Rockefeller Institute for Medical Research. He was dismissed from the latter post in part for publication of controversial essays. de Kruif then collaborated with Sinclair Lewis on Arrowsmith, Lewis's early medical thriller/satire about a doctor fighting bubonic plague, for which Lewis turned down the 1926 Pulitzer Prize for Fiction. While Lewis received sole author credit, de Kruif contributed enough to receive 25% of the book royalties (1, 7, 8, 9, 10).

After his Arrowsmith collaboration, de Kruif published "Microbe Hunters", a nonfiction work containing profiles of scientists. He also contributed articles on science and medicine as a staff writer for a number of magazines. Like many other journalists of his day, de Kruif had a tendency towards alarmist language. Correspondence from Clifford Dobell, a British protozoologist and friend, states this rather bluntly, with regards to "Microbe Hunters": "Do you think that you have written a serious scientific history of the subject?... You wrote it, in the first place, to make money…In the second place, you wrote the book in order to teach the ignorant; and you put its truths in vulgar (and therefore often slightly inaccurate) words, so that vulgar minds could grasp them. In this you have succeeded." (4) While none of the headlines in January 1930 were from de Kruif, he played a major role in documenting the aftermath (1,4, 9).

The scientists at the PHS Hygienic Laboratory began with little information about psittacosis but were able to determine that the pet shop that sold Simon Martin his sick parrot had sold an additional 36 birds. Some of those parrots and four pet shop employees were ill. To continue to gather information, the scientists cabled public health departments nationwide. This necessary step unfortunately led to panic in the early days of the disease. Newspapers included other forms of pneumonia in the death counts, and cases where no autopsy had been conducted. City health commissioners advised killing pet parrots or turning them in to local zoos. By January 15th, newspapers realized they had overstated matters and veered too strongly in the opposite direction, with the Chicago Daily Tribune reporting "U.S. alarm over parrot fever not warranted", and people across the country began making parrot jokes (1, 2).

The problem was far from over. As described later by de Kruif, Armstrong was pulled from what he initially felt were more important tasks: "Armstrong packed his satchel. The day before he'd been miles below the surface of the hurly-burly of everyday life, deep in fumbling with the mystery of post-vaccinal sleeping sickness. That was really important business, affecting the health and the lives of hundreds of people vaccinated for smallpox. It was a threatening business, beginning to shake health officers' sureness when they told folks that smallpox vaccination was entirely harmless. Now Armstrong had to ditch it, and it was lamentable and seemed frivolous, because only people with parrots were in any danger, and didn't people who kept parrots deserve it?" (4) Armstrong and Anderson got to work, and de Kruif later describes some of the conditions they experienced at the Hygienic Laboratory. While his description is likely embellished and is certainly written in the flowery language common at the time, it has been well-documented

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Parrot Fever and the Birth of the NIH…

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that the Hygienic Laboratory was indeed underfunded. (4) "It was now the 16th of January and Armstrong and Shorty were in the dingy basement of the Hygienic in a couple of dank, frowsty little holes hardly bigger than coal-bins, an insult to offer any self-respecting microbe hunter for a laboratory. They practiced getting parrots in and out of cages they'd rigged up from garbage cans with wire -mesh covers. Going by the doors of their rooms in the cellar you sure got an earful while Armstrong and Shorty got over being hams as parrot-handlers." (4) The birds Armstrong and Anderson were trying to infect to determine next steps began to get sick and "now more and more birds changed from screaming varmints to what looked like sick philosophers." Unfortunately, people also became infected. Several laboratory workers, including Armstrong, were transported to the US Naval Hospital for treatment. Some did not survive, most notably Henry "Shorty" Anderson, Armstrong's assistant. Scientists at the Hygienic Laboratory eventually used convalescent serum to treat the infected, and this likely saved Armstrong's life. Today, culture of C. psittaci is discouraged unless in a specialized laboratory, as it is highly infectious when cultured, and aerosol transmission to laboratory personnel is a significant risk (1, 2, 3, 4, 6)

By February, 11 of the 54 employees in the Hygienic Laboratory had been hospitalized, two had died, and McCoy had decided that drastic action needed to be taken. Killing only the parrots was not enough. Any animal that had been part of the experimentation needed to be sacrificed. The scene described in "Men Against Death" is chilling: "That Saturday afternoon if you'd been standing by the red brick building and looked up at the sparrows flying over the roof, you'd have seen them suddenly hesitate in their flight, then nose-dive down onto the roof, dying. No…not from parrot fever." (4)

Earlier that day, animals were removed from non-psittacosis-infected labs and the Hygienic Laboratory closed. McCoy sent everyone else away and chloroformed the remaining birds and animals. After incinerating the remains and washing the cages with cresol, McCoy called for fumigation experts to seal the building and fill it with cyanide gas. Birds flying above supposedly died from the fumes (4).

In total, over 750 people worldwide were infected during the pandemic (Table 1), with a mortality rate of 15%. In May 1930, two months after the fumigation of the Hygienic Laboratory, Congress passed the Ransdell Act, which reorganized, expanded and renamed the Hygienic Laboratory as the National Institute of Health, and appropriated $750,000 for construction and research fellowships. The Act was sponsored by Louisiana US Senator Joseph E. Ransdell, a long-time proponent of public health. Ransdell had sponsored legislation to eradicate Texas tick fever while in the US House of Representatives. He later chaired the Senate Committee on Public Health in 1916, leading to the establishment of a national leprosarium. Ransdell first introduced a bill to establish a National Institute of Health in 1926, finally succeeding in 1930. The pandemic may have been the final push needed for the Act to pass. After losing his Senate seat to Huey Long, Ransdell remained in Washington for three years as executive director of the conference board of the NIH. While Ransdell's lobbying was of highest importance on obtaining the funding and enacting the legislation, the new Institute was also clearly a reward to McCoy, Armstrong, and the other Hygienic Laboratory scientists for their heroic investigations into this little remembered pandemic. The campus has continued to expand since its move to Bethesda, Maryland in 1938 (Figure 3 on pg 20), changing its name to the National Institutes of Health in 1948. (6, 2, 11).

Table 1: Deaths Reported by Select Countries in 1929-30 Parrot Fever Pandemic

Country	Infected	Died
Algeria	7	4
Argentina	100+	2+
Germany	215	45
United Kingdom	100	Unknown
United States	169	33
Worldwide	700-800	15% mortality

Psittacosis has never again reached pandemic levels, but has not gone away, remaining a notifiable disease in most countries. Epidemics were reported in the United States through the 1960s, with outbreaks in the 1980s and 1990s in the US and European poultry industries. C. psittaci is believed to be endemic in the Belgian turkey industry today, though infections appear to induce only mild symptoms. Outbreaks related to contact with infected ducks have also been reported in the 2000s (4). While

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Parrot Fever and the Birth of the NIH…

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Figure 3: National Institutes of Health Looking West Aerial. March 21, 2022. Source: Duane Lempke Photography / Wikimedia Commons / Public Domain.

treatment is now possible, the disease is not without complications, even in modern times. A 1997 case report discusses an acute glomerulonephritis secondary to psittacosis diagnosis in a 38-year-old male. He was infected from a pet cockatoo and recovered (12). More recently, the Virginia and Georgia departments of health and the Centers for Disease Control (CDC) investigated a multistate outbreak of psittacosis occurring at two poultry slaughter plants. Unlike the days of the Parrot Fever Pandemic, however, the CDC can perform confirmatory laboratory testing and antibiotics are available for treatment (13).

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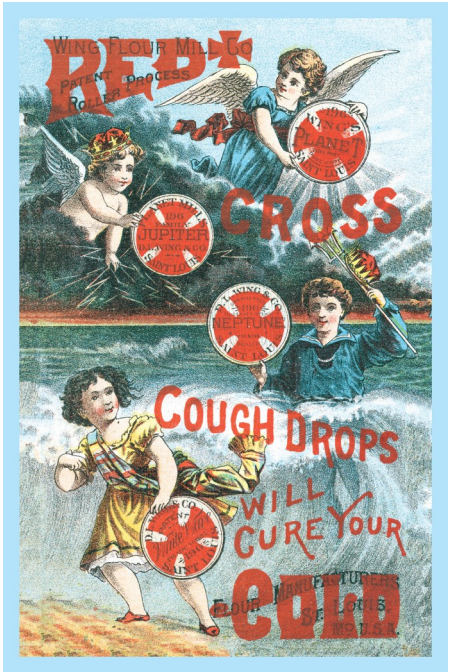
Advertisements through history



Tylenol and Cyanide…

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with this tragedy? To their credit, the company executives developed a plan to protect the populace and prevent further deaths. Initially they only recalled the product identified by the four affected lot numbers. Within a week, though, they recalled all Extra Strength Tylenol capsules, some 31 million bottles representing $100 million. Executives of the company devised a 2-phase program to save the company. Phase 1 would be handling the crisis while Phase 2 would be to re-instill confidence in the widely popular Tylenol brand.

During Phase 1, the major goal was customer safety. Consumers were alerted to the potential problems while production and advertising of Tylenol ceased. Since it was recognized that only capsules were involved, Johnson and Johnson offered to replace all previously purchased Tylenol capsules with tablets. The company demonstrated complete co-operation with police, the FBI, and FDA and dealt honestly with the media to alert the public to the recall. Because of their co-operation with the media, Johnson and Johnson was given favorable publicity.

In November of 1982 the company began to re-introduce Extra-Strength Tylenol capsules in triple-sealed, tamper resistant packages. Prior to this event, over-the-counter drugs were sold without any type of seal. Bottles had simple screw caps or flip-tops with a plug of cotton stuffed in to prevent damage to the tablets or capsules during shipping. If the bottle was in a box, the box was not sealed and could be opened and re-closed without any evidence of tampering. Similarly, food items were often not sealed. Johnson and Johnson's new triple sealed product consisted of a box that had glued flaps and contained the bottle. The bottle had a plastic seal around the cap and foil seal over the lip of the bottle. The company also offered a discount coupon to anyone who requested it through a special toll-free phone number. The price of the product was reduced to make it more competitive. The sales staff was specially trained to make presentations emphasizing the company's commitment to consumer safety. In general, Johnson and Johnson won praise for setting industry standards on how to deal with a crisis. Unlike previous tragedies, such as Elixir Sulfanilamide, the company did not attempt to shift blame. Instead, they prioritized protecting the public, not protecting profits. This approach has been widely

Tylenol reintroduction advertisement

proclaimed as what saved the company and business schools still use this as a case study of how to recover from a devastating tragedy.

No motive was ever clearly delineated for these murders. There was no evidence of unusual trading activity of Johnson and Johnson stock so no one directly profited from commodities trading. Victims were all young and middle class with no large insurance policies. Authorities have concluded that the perpetrator may have had a hatred for humanity or a desire for notoriety. This, however, is only speculation and cannot be confirmed unless the poisoner identifies themself and explains their purpose or reason. After so many years, this seems unlikely.

The obvious first concern for investigators was that someone at the Tylenol packing plant had introduced the cyanide-laced capsule. However, the different lot numbers had been shipped from different geographical areas (Pennsylvania and Texas) suggesting that it was unlikely that it was an employee. It was finally concluded that someone, probably one person, had stolen (or purchased) bottles of Tylenol, carefully opened capsules, replaced part of the drug with cyanide and then returned the bottles to the stores from which they were taken.

Johnson and Johnson offered a $100,000 reward for information leading to the conviction of the murderer. No one was every apprehended for this specific crime, although there were some suspects.

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Mortar and Pestle…

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cists became increasingly aware of the toxic properties of certain metals and these mortars were gradually replaced with other materials such as Wedgwood, iron, porcelain and glass.

It was at this time that the Wedgwood mortar was introduced in England by a well-known potter, Josiah Wedgwood (1730- 1795).[2,3] The Wedgwood mortar, made from a type of earthenware, called "biscuit ware" or unglazed porcelain, appeared in 1779 and it quickly became the predominant mortar and pestle used in pharmacies. The pestle also combined the earthenware pottery with wood for added strength in the handle.[7,10] These mortars and pestles are still used today.[10] Wedgwood mortars and pestles provide a strong grinding surface and are best suited for powdering crystalline solids and other hard substances.

Wedgwood mortars were usually embossed on the base with a number indicating the size and the pestles were marked with a matching number.[9] The smallest mortar was marked size number 0000 (3 ounces), and the largest made by Whitall Tatum in 1916 was size number 12 (2.75 gallons).

Wedgwood and Bentley Mortar and Pestle, 1780.[15]

Mortar and Pestle Material Considerations

Over the years, it became evident that mortars and pestles should be made of materials that are strong, inert, and heavy.[8] The material shouldn't flake off, chip, crack, shatter, or break from the constant pounding, grinding, smashing, and scraping.[8,9] In addition, the mortar and pestle should be easily cleaned and not absorb what is being mixed.[8]

Wedgwood mortars and pestles can be used to reduce substances to very fine powders, but can stain easily.[6,10] Porcelain mortar and pestles do not usually stain, but cannot produce as fine of particles as Wedgwood.[6] Porcelain mortars were sometimes conditioned for use by grinding sand to give them a rougher surface which helped to reduce particle size. Glass mortars and pestles are fragile, stain-resistant, and are suitable for use with liquids. However, glass mortars and pestles do not grind as finely as with the Wedgwood type. Wood mortars and pestles are highly absorbent and are not suitable for medications.

Epilogue

Mortars and pestles became less and less common in its traditional pharmaceutical setting as the 20th century progressed.[8] As drug manufacturers commercially produced medications, the need for the pharmacist to compound preparations became less.[11] As a result, the use of the mortar and pestle started to diminish and it took on a different role, which became more of a decorative piece placed on the pharmacy counter. This may have also prompted some drug manufacturers and pharmacies to use the mortar and pestle as one of the ways to advertise their name and products. The mortar and pestle is still used today in pharmacies, but much less frequently, except for those pharmacies which still do quite a bit of compounding.

A mortar and pestle fun fact: in Slavic folklore dating from 1755, Baba Yaga, a supernatural being who appears as a fierce-looking grandmother, flies around in a mortar and uses a pestle as a rudder.[7]

Baba Yaga, 1904.[12]

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Tylenol and Cyanide…

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The way companies do business was drastically changed by this incident. Most food and drug containers are now at least double sealed. There are warnings on most containers not to use them if the seals have been broken. The use of capsules has been greatly curtailed as tablets and caplets are more difficult to tamper with. A new dosage form, called gel caps, was introduced. These are sealed gelatin capsules that cannot be opened without destroying the product. A tamper resistant packaging act had been implemented in 1980 but only certain drugs, cosmetics and medical devices were covered by the act. FDA issued new tamper-evident packaging rules on November 5, 1982. In addition, FDA developed a "chemical fingerprinting" lab to trace the origin of substances used in tampering. In 1983 a federal anti-tampering act amended the U.S. Code to establish penalties for tampering or threatening to tamper with products covered under the Food, Drug and Cosmetic Act. It now became a federal offense to tamper with consumer products and there are heavy penalties for anyone convicted under this law.

Johnson and Johnson was sued for these incidents. Though the FDA found the company blameless, the families of the victims received an undisclosed settlement from the company. Prior to this incident, Tylenol accounted for 37% of all over-the-counter analgesic sales. At the height of the panic, Tylenol had less than a 6% share. By 6 months after the initiation of the recovery Tylenol was back to a 32% share and once again the number one analgesic.

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Advertisements through history

Bezoars – Miraculous Panaceas of the Past…

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mately concentrating and congealing into a bezoar. This positions the bezoar both useful as an antidote to venomous serpents via "sympathetic attraction" and to melancholy, due to the "cold and dry nature of the stag."[2]

In India, bezoars had long been used for snake bites, fevers, depression, and bleeding. Wealthy princes took bezoars prophylactically twice yearly for strength and vitality. Once in Europe, bezoars were hailed as more effective than the established antidotes of the time – theriac and mithridatum.[3] In addition to snake bites and most poisons, they were touted to treat "plague, typhus, malignant fevers, melancholy, fainting, palpitations of the heart, vertigo, and intestinal worms."[1] In one account, King Edward was cured of a "poisoned mortall wound" after a "greate maister of the Templers" administered him a "Bezaar Stone."[6]

By the sixteenth century, the bezoar's status as an exotic panacea secured their hallowed status in magistrates' treasuries. Princes held "poison trials" to showcase their bezoar stones – their personal physician administered a preparation of bezoar to condemned criminals after poisoning. If the criminal lived or survived longer than anticipated, the bezoar was proven successful. If the criminal died, the antidote's failure was attributed to an impotent preparation or a counterfeit stone from an irreputable dealer. These shows were not intended to prove the bezoar's effectiveness; rather that the prince possessed a signature remedy against poison.[8]

Administration and use of a bezoar ranged from the pharmaceutical to the mystical. A Persian treatise from the late sixteenth century instructs the victim of a poisonous insect or snake bite to grind up a bezoar stone with a fennel infusion and apply the resulting poultice to the wound, removing both pain and poison. Specific quantities of bezoar are prescribed for specific maladies. For instance, to cleanse the body's humors, one should grind two grains in rosewater or milk and take orally, follow it with sweetened rosewater after an hour, then some bread and lentils for lunch; this should be done for three days at the advents of spring and autumn. The same three-day treatment can also be prepared with a much more opulent mixture of ground bezoar, ruby, sugarcane, exotic wood, white ambergris, musk, mastic, gold and silver leaf, and white bamboo concretions.[6]

In Europe, ground or shaved bezoar was typically mixed in wine for consumption. It soon became popular to wear the bezoar around the neck; this way, the bearer could conveniently dip the entire stone in wine. The necklace furthermore served as a talisman, warding off plague and other ill health, and as a display of wealth. These wearable bezoars were often housed in delicate gold filigree to allow for greater contact with skin and transmission of the stone's healing power.[2]

Kings, queens, and emperors set their larger bezoars in gold, adorned them with precious stones, and displayed them as talismans.[3] Other miraculous curative substances like unicorn horn were often incorporated into the elaborate presentations. Small quantities of the exposed stone surface were shaved off for use before returning the bezoar to its ornate and prominent position.[8]

Some physicians doubted the bezoar's legendary efficacy. Ambroise Paré tested the antidote on a criminal: a cook who stole his cutlery. The thief agreed to poisoning and subsequent treatment with bezoar. He died "in terrible agony" in six hours, confirming to Paré that the bezoar was not infinitely beneficial. Another, Caspar Bauhin, complained that physicians were pressured into using bezoars to maintain their magistrate's favor. He did, however, find them useful for promoting good health by causing sweating and cleansing the humours.[3]

The bezoar's decline in popularity coincided with the rise of modern scientific experimentation. In the late eighteenth century, Joseph Louis Proust, chemist and pharmacist, detailed his findings on Peruvian bezoars. They "smelled of animals" and were reduced to charcoal when burned. He noted they reacted with sulphuric acid to release selenite and phosphoric acid. Their composition was predominantly phosphates, resins, fibers, and animal hair.[5] By the nineteenth century, bezoars had fallen out of use almost entirely.[4]

But what caused the bezoar's longevity? Was its status merely a product of exotic legend, or was the bezoar genuinely useful as medicine? Research suggests that bezoars, although not a miraculous cure-all, provided real benefit. Certain Old-World bezoars – the costliest and most highly coveted – contain high concentrations of ellagic acid, an antioxidant commonly found in fruits. This may have provided symptom relief from com-

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Pharmacy Chronicles

American Association of Colleges of Pharmacy AACP

HISTORY OF PHARMACY SIG NEWSLETTER
Published by:
History of Pharmacy Special Interest Group,
American Association of Colleges of Pharmacy

"THE HISTORY OF PHARMACY LIVES HERE…

…THE FUTURE OF PHARMACY BEGINS HERE."

—UNIVERSITY OF KANSAS, AT LAWRENCE, SCHOOL OF PHARMACY MUSEUM

About the History of Pharmacy SIG

The academic year (2022 – 2023) marks the fifteenth year since the History of Pharmacy Special Interest Group (SIG) was formalized as an AACP SIG.

As an open academic forum, the SIG strives to facilitate the exchange of ideas and innovation among pharmacy faculty across disciplines; to serve broadly as an accurate information resource for teaching, learning, and scholarship pertaining to the evolution and history of the pharmacy profession; to develop and maintain historical collections of artifacts and school or college museums; and to ensure the lessons, the message, and the legacy of the pharmacy profession is preserved to educate future generations of pharmacy students.

The SIG's mission rests on the premise that the history and legacy of the pharmacy profession will always be relevant to all pharmacy practice areas, including current and future scopes of practice. The History of Pharmacy SIG is relevant to you too! Join the History of Pharmacy SIG!!

Bezoars – Miraculous Panaceas of the Past…

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mon diseases in addition to general promotion of good health and vitality.[4,5] Indeed, the porcupine bezoar is still popular on the Malay Peninsula as an antioxidant.[3] Similarly, the bezoar's status as an antivenom is not merely legend: the stone material draws fluids out of a wound via capillary action. Grinding a bezoar into a poultice may have provided sufficient surface area for effective treatment.

Perhaps most importantly, recent research shows the bezoar was a somewhat effective antidote to the "most commonly used poison in European courts"[3] at the time: arsenic. Animal hair is a significant component of a bezoar's composition, and the sulfur in these partially digested hairs binds and chelates arsenic.[9] So, the princes may have been at least somewhat correct: the bezoar may have been effective both as prophylaxis and treatment against poisoning.

Bezoar stones may not have a mythical origin, but their purported medicinal effects proved legendary. While bezoars remained in the London Pharmacopeia as late as 1746, society's understanding of pharmacology and toxicology expanded and their use as a medical agent faded into the past. Bezoars stones are still highly valuable collectibles with prices varying based on size, shape, age, and animal source.

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