

# The Science and Philosophy of Cherokee Indian Medicine: A Natural Alternative to Western Solutions

S. Barron Frazier, Sharon I. Goad, and Michael J. Wolyniak

*Department of Biology, Hampden-Sydney College, Hampden-Sydney, VA 23943*

Healing cannot be defined as the physical removal of a disease, cancer, or pathogen from a living organism. Healing heavily relies on a person's quality of life improving, and this result is only possible if the illness is removed from the spirit in conjunction with the removal of the illness from the body. Western medicine today has fallen ill to looking at patients as living organisms rather than human beings and overlooks the importance of addressing the health of a person's spiritual being. Cherokee medicine, on the other hand, takes a different approach to healthcare that focuses first on the purity and wellbeing of the soul before addressing the condition of the body. This philosophy of healthcare, coupled with the extensive use of different natural herbal medicines, creates a care pathway that provides new solutions to current health-related problems today. With more people struggling to afford healthcare, understanding the Cherokee culture can provide affordable alternative medicine like goldenseal and geranium plant oil to cure their ailments. Additionally, using Cherokee medicine can improve the way doctors and nurses approach patients in the healthcare setting and can ultimately lead to a quicker recovery or a greater quality of life by focusing on the health of a person much as the pathogen or disease that they seek to eradicate.

## INTRODUCTION

In today's world, the engineering of medicine costs billions of dollars each year and remains a constant arms race to counteract the evolution of the pathogens that infect us. Considering that practically 100 years ago physicians used bloodletting as a standard procedure for illness, Western medicine has grown quickly with the advances of technology. These new medicines and procedures do help, but arguably, the advancements of technology and science have evolved quickly and in the pursuit to keep up with these discoveries, we may have overlooked the benefits of investigating the past for clues of natural cures. Older cultures like those of the Native Americans managed pain using plants like willow bark, leading to the discovery and production of aspirin today. Many people readily use alternatives like Echinacea, a plant used by the Plain Indians, to strengthen the immune system during a cold in place of, or in addition to, synthetic medicine.

With more artificial compounds being produced and the growing resistance of pathogens, the desire for all-natural supplements has grown. Popular medicines like ginseng and acupuncture therapy obtained from Eastern cultures promise improvement in daily health and energy, yet these therapeutic activities are only a piece of improving a person's quality of life. Eastern cultures' philosophies of healing focus on balance in daily life, and this key principle is responsible for promoting spiritual and bodily health. The benefits gained from therapeutics derived from plants or from a relaxation technique like yoga are finite without infusing the culture's philosophy of healing into our own understanding. It is the aim of this research to reconsider the Western definition of healing and medicine by studying the philosophy of health and medicine of the Cherokee, a

traditional culture from the grounds of North America. The study will also test two different plants used by the Cherokee for their assumed antifungal/antimicrobial properties. Of course, it would be shortsighted not to acknowledge the achievements and benefits of Western medicine; the duration of life and the quality of life has improved significantly over the past century. The incorporation of other cultures' understanding of medicine and healing like that of the Cherokee, however, can provide insight on how today's healthcare can be improved, ranging from how physicians interact with patients to the type of medicine prescribed.

While this new culture in society has benefited from looking towards Chinese medicine, much of the medicinal past from North America remains untouched as the "ancient, indigenous Southern Indian herbalism languishes in obscurity at our doorstep" (Hudson 160). Traditional communities and cultures like the Cherokee remain hidden in tradition, and from the use of trial and error over hundreds of years, it is reasonable to expect that some of these plants may have considerable medicinal value. Finding the benefits of Cherokee medicine first requires a thorough understanding of Cherokee culture to understand health, healing, and the application of medicine.

Unfortunately, this requisite comes with hardship as the Cherokee lacked written records for the majority of their existence. Additionally, the Cherokee culture has changed with the arrival of the white man in North America in the 17<sup>th</sup> century and the Cherokee's removal in 1831 during the Trail of Tears. Fortunately, it is believed that "although the Cherokee had been involved in trading with whites since 1690, it was not until the 1790's that real

change seemed to appear in Cherokee myths and legends” (Payne 11).

Although we must rely heavily on the accounts of white anthropologists who aimed to record the original traditions of the Cherokee, these records performed by white anthropologists like James Mooney and John Howard Payne are deemed accurate and are accepted by the members of the Cherokee Nation that aim to remember their ancestry. Mooney and Payne both lived among the Cherokee for a long duration during the late 19<sup>th</sup> and early 18<sup>th</sup> century respectively, and their accounts of the Cherokee are one of very few highly regarded primary resources used today to study the Cherokee culture prior to the Trail of Tears. From the early accounts of anthropologists come the healing secrets of medicine men who over hundreds of years found by correlation the medicinal value of plants that exist in the Southern Appalachian region. Although not all plants used by the Cherokee have medicinal value, the combination of the Cherokee’s healing philosophy and experience in using plants such as geranium and goldenseal for cures may provide a new solution to healing and strengthen our arsenal of medicine that people receive currently.

#### ***A Cultural Perspective of the Cherokee Indians***

The Cherokees claimed about 40,000 square miles of territory in parts of today’s North Carolina, South Carolina, Tennessee, and Georgia. As defined by Gary C. Goodman, the Cherokee lands can best be described: as the part of eastern North America that makes up the core of the southern Appalachian highlands. This area may be subdivided into five zones: the southern Appalachian mountain system, primarily high mounts; the Piedmont plateau, primarily “upland”; the Appalachian valleys and ridges, parallel mountain ridges; the Cumberland plateau, an escarpment sloping to the southeast...; and the interior low lands, a low plateau. The core area of Cherokee settlement—about 40,000 square miles...—covered most of the southern Appalachian mountain system and parts of the central portions of the Appalachian valleys and ridges and the Piedmont plateau (Thornton 11).

Within these three regions existed approximately 50-60 towns. Notably, these regions, shown in Figure 1 (McEwan 204), spoke a different dialect, as the Lower Towns spoke *Elati*, the Middle Towns spoke *Kituhwa*, and the Overhill and Valley Towns spoke *Atali* (Mooney, “History, Myths” 16-7). Following this trend, these regions were not united under a single leader and existed as seven different clans with each town representing itself individually. The French, when trying to become allies with the Cherokee, made the mistake of assuming one

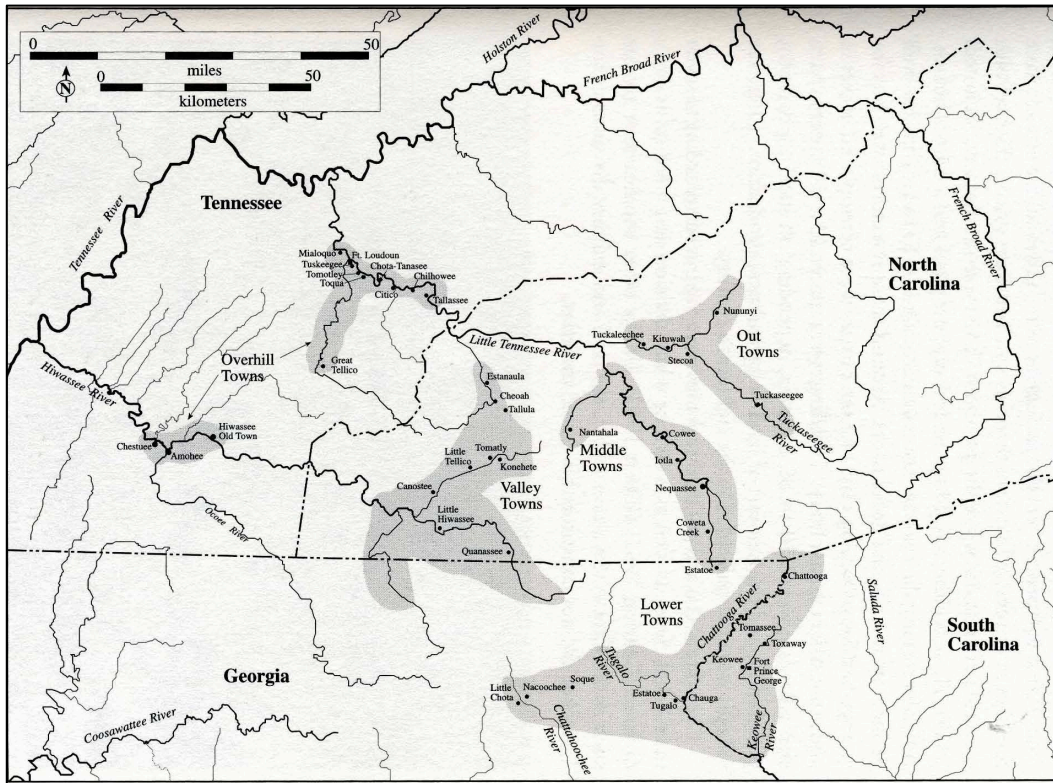
Cherokee leader spoke for the entire tribe and became frustrated when they sought the full support of the Cherokee yet only received the help of one town (Mooney, “History, Myths” 15).

The Cherokee nation was a perfect example of a dual organization, or a “system of antithetical institutions with the associated symbols, ideas, and meanings in terms of which social interactions take place” (Hudson 234). These people all had the same beliefs, and their practices within their respective town encouraged their group identity. The Cherokee also did not believe in material wealth and discarded or used any of the excess materials gained in each season. John Lawson who lived amongst them during the 18<sup>th</sup> century believed their practice was prudent, as “riches...are as often in possession of a Fool as a Wise man” (Perdue 13-4). Slavery arguably also contributed to the identity of the Cherokee. Slaves were obtained through warfare, and captured men would become *asi nahsa’l* or “one who is owned” (Perdue 13). These slaves provided the necessary role of deviance in Cherokee society, thereby identifying the common beliefs and principles and group identity in a clan; by demonstrating the “dangers of not being a Cherokee, the slaves helped strengthened group identity among the Cherokees” (Perdue 17-8). The strength of the uniformity of beliefs and practices in society, whether based on purity or the presence of slaves, played in favor of a healthier lifestyle as it shielded Cherokee people away from perceived unhealthy habits.

#### ***Cherokee’s Introduction to White Foreigners***

With the introduction of settlers in the Cherokee lands, trade and land became the most important sources of conflict. Until the mid-1700’s, the Cherokees had good relationships with the English and the French, but they did not welcome foreign ideologies into their culture. For the most part, Cherokees were diligent in protecting their society’s beliefs and principles and maintaining the integrity of their classification system from falsification (Hudson 148). The practice of cultural conservation employs much more than the daily habits of a person; it maintains order in a community that has found the best way to live in its environment for hundreds of years. The Cherokee wanted to maintain their spiritual and collective health and in order to prevent entropy from entering into their society, the Cherokee made regulations to reduce the mixing of categories and held ceremonies to rid themselves of societal pollution (Hudson 148). They focused on purity physically, maintaining a rule to continually clean themselves on a regular basis, including after events such as after battle, after intercourse, and so on; unless purified, a Cherokee tribe member would not

be allowed to engage in any business whatsoever (Payne 257).



**Fig 1.** A map of the 18<sup>th</sup> century Cherokee settlement areas and principal towns.

As generations passed, the Cherokee society and daily life changed, some practices for the better and some for the worse. For the better, selective crops and new animals helped resist famine, disease, and warfare. For the worse, the introduction of horses removed the natural flora and made it more difficult to find typical plants and animals used for medicinal and nutritional purposes (Wood 237). The introduction of rum and guns encouraged degradation of Cherokee culture, and in order to obtain necessary goods like salt, the Cherokee had to focus on producing extra in order to trade (Wood 230). Herbs and medicines became scarce, and this dilemma led to a polarization between the elders and the younger generation who saw the plants value differently (Wood 234). The white settlers changed the dynamic of the Cherokee communities, and with the new misdirection, the Cherokee lost its harmony and the unity that maintained a regimented way to live a healthy life as perceived by the Cherokee.

These changes may not have been stressful to all societies, but based on the severe population shifts over a short period of time, these foreign

pressures were felt throughout Cherokee lands. Population estimates are a little unclear, but James Mooney estimated a Cherokee population of 22,000 in 1650. Peter M. Wood believed that Mooney underestimated the Cherokee population and estimated 30-35,000 in 1685 (Thornton 15).

With new people come new diseases, and the Cherokee's population decreased by one half in less than a year due to smallpox (Wood 64-5). James Adair recalls that the "Cherokee were a very numerous and potent nation. Not above forty years ago, they had 64 towns and villages, populous, and full of women and children" (Wood 64-5). By looking at the population trend from 1685 (32,000) to 1700 (16,000) to 1760 (7,200), the Cherokee population maintained negative growth for almost a century (Wood 64). These declines would place a larger workload on the Cherokee people and put pressures on their beliefs.

After relations deteriorated with the white settlers, leading to war, the Cherokee suffered great reductions of land. Regardless of these changes, the Cherokee's group identity helped them ward off

changes in their beliefs. Wood writes that the face of the military aggression and economic power problems within their towns...the Cherokees fought to avoid either political or economic colonization" (Wood 243). This due diligence to maintain their belief system and culture demonstrates a strong will to practice what has worked well previously. From the response of the Cherokee to these pressures, it is believed that there is no evidence for fundamental changes in Cherokee institutions like medicine from 1671-1745 (McEwan 216).

### **The Philosophy and Structure of Cherokee Medicine**

Ancient healers were called kv-ni-a-ka-ti from Kv-ni, an arrow, because these doctors followed the course of the arrow in healing the wound made by it (Payne 220). The practice of Cherokee medicine followed the teachings of the ancient healers as it relied heavily on the use of correlation between specific analogies and the ailment, such as yellow flowers heals jaundice. Scientists have claimed that many of the plants that were used had no effect or were used incorrectly. Some plants, however, proved to have great medicinal value in curing certain ailments and in some cases, provided more advanced treatment than that available in the Western world. It is important to recognize that the plant or medicine by itself does not equate to the cure; it is the delivery of the ritual and presence of the medicine man that heals the spirit and activates the medicine concoction. From knowing how priesthood was obtained, those outside of the Cherokee tribe can understand why the knowledge of their medicinal practices is rather incomplete and remains sacred to the tribe to this day.

### **Priesthood**

Candidates for priesthood typically were chosen before birth from preselected families with a history of priesthood (Payne 31). At birth, the male child would receive a consecrating concoction that began a process of becoming a priest. The child would remain in the view of the active priest in the tribe in order to ensure his purity by keeping him from eating certain foods and helping him to understand his role by practicing fasting (Payne 31). At the age of 9 or 10, the child would follow the priest to a mountaintop, drink the purifying drink, and maintain focus on the sun for the duration of the day (Payne 32). The following day, the priest would take his pupils to an undisclosed part of the mountain to teach them the secret powers of the Divining Crystal and the accompanying prayers and rituals (Payne 32). The Divining Crystal, or the "Ooh'lúng-sat-tah, was typically made out of chryselline quartz and was a highly sacred and powerful tool to be used only by the priest (Swanton 230). The priest would look in the

"Cherokees continued to rebuild their towns in the

crystal and look for destiny that took the form of an aged man with grey hair. If his interpretations were perceived as good, the boy was taken to the river and ordered to submerge completely in the water seven times in succession facing both east and west (Payne 33). The pupils would then attend a sacrifice performed by the priest. The priest would continue to monitor his pupils beyond initiation, but once he became ill, he would call them, ask them to repeat all of his instructions, and then give the Divining Crystal to his successor (Payne 33).

After accepting this lifestyle, these new priests understood the importance of the teachings of their instructor and the need to keep them secret. It was common belief that passing these secrets to people who did not receive the training would lead to the decline of both the betrayer and the listener. This practice explains why it has been difficult to extract information about their practices, especially by any white person, "all of whom are supposed to feel a contempt for such forms and faith...this is the reason why it is impossible to communicate complete details, and to give an account of the deeper mysteries and of the forms of prayer and incantation taught by the priests to their pupils" (Payne 33). The secrets that have been disclosed to James Mooney and others who lived among the Cherokee provide some insight, but all records must be assumed as incomplete to some degree. For example, as James Mooney asked Swimmer, a priest, to sing a song, Swimmer refused to provide the information and made an excuse for not singing (Mooney, "Swimmer" 311). He explained that he was willing to speak of the stories and customs of the Cherokee, but certain aspects including songs are sacred and must remain a part of his secret knowledge. It is important to remember that what we know is deemed by the Cherokee as sufficient knowledge for an outsider. As also stated by Butrick in 1840 in a letter to John Howard Payne, the secrets of the Cherokee "are known to but few among themselves...and those who have the knowledge requisite have received this knowledge as a sacred deposit, and would rather die than betray their trust...some of their ancient customs were not to be made known to any except sons designed for" (Payne 10).

### **The Creation of Disease**

The development of rituals made by a medicine man follows the belief that animals created disease to punish man. The myth creates a template for all rituals as the medicine man beckons to a spirit to rid the evildoer, typically another animal. Understanding the myth is key to recognizing that

healing spans far beyond the medicine but to the power of the priest to overturn the misfortune of a Cherokee. The myths of the Cherokee claim that the animals at one time felt as if man had offended them by the reckless killing of their brothers and sisters. The bears first held a council and decided to go to war with man due to their transgressions. They decided to fight man with bows and arrows made out of wood and the entrails of the bears. One of the bears sacrificed itself for their cause but when another bear tried to fire the bow, his claw would get caught when releasing the string. The bears then decided that they must cut their claws, but their chief, the old White Bear, said that if everyone cut their claws, no one will be able to climb trees and will starve. They decided, "it is better to trust the teeth and claws which nature have given us" (Mooney, "History, Myths" 320) and dissolved their council.

Then the deer held a council led by Little Deer and decided to punish the hunters who did not explain the need to kill the deer by inflicting rheumatism on their fingers. Little Deer would run through the forest and ask the ascending spirit over the killed deer whether the hunter had asked for pardon, and it would punish those who did not follow their regulations. The fishes and reptiles also met as a separate council to speak of their own distaste for how they were treated by man and determined to make their victims dream of snakes or of eating decaying fish so that man would lose his appetite, become sick, and die, potentially explaining the interpretation of dreams understood by the shaman or priest (Mooney, "History, Myths" 321).

Lastly, the birds, insects, and smaller animals held a council and began to compile a variety of ways to punish the humans. The plants, who looked kindly toward man, heard of the animals' mischievous inventions to punish man and decided to help the Indians by becoming the antidote or cure to these ailments. The plants said "I shall appear to help man when he calls upon me in his need," leading to the creation of medicine (Mooney, "History, Myths" 322).

The myth of the origin of disease has developed in the Cherokee culture to suggest that death is caused by the evil or the invoked power of spirits. Haywood in 1823 wrote that "in ancient time the Cherokees had no conception of anyone dying a natural death. They universally ascribed the death of those who perished by disease to the intervention or agency of evil spirits, witches and conjurers who had connection with the evil spirits" (Mooney, "History, Myths" 322). This particular responsibility in illness created by evil spirits alludes to the medicine men's ultimate focus to purify the spirit rather than the body, as the body only suffers due to the degradation of the soul. Mooney, perhaps due to the time he studied the Cherokee (late 1800's), did not believe strongly in the

ideology of medicine that was practiced. He did believe, however, that "their theory and diagnosis are entirely wrong...many of the plants used in their medical practice possess real curative properties, but it is equally true that many others held in as high estimation are inert" (Mooney, "History, Myths" 322). Their healing process is simplistic in design and covers the basic desires of life—"for health, for long life, for success in the chase, in fishing, in war and in love, for good crops, for protection, and for revenge" (Mooney, "History, Myths" 319). With the consideration of the primary interest in healing the soul, we can analyze the medicinal methodology of the priest.

### ***The Diagnosing Guide for Medicine Men***

Some of the practices for healing were widely known by the Cherokee tribe and would be used first before requesting the priest to cure an ailment. The priest would first require a deerskin or a piece of cloth for each ceremony performed (Hudson 342) in order to provide his service. The priest would first try to identify the disease and would question the patient to learn if he or she had violated some societal rule; if not, the priest would ask the patient about his or her dreams, as dreams were warning signs of things to come (Hudson 244). For example, to dream of seeing any person going towards the west is a sign that person is soon to die and to dream of seeing any one with eagle feathers in hand...is a sign of death and mortality (Payne 238-9).

In serious illness, the Cherokee priest would place the patient in exclusion. Common belief suggests that this practice was to remove the patient from being near menstruating women, as it would make the priest's medicine ineffective, but it is practical to think that isolation was also used to maintain the purity of others. Mooney argues against that idea, as no sanitary precautions were taken to aid in the recovery of the sick man (Mooney, "History, Myths" 330). Mooney draws from his experience when Tsiskwa, an old shaman who was confined to his bed due to illness, requested that he visit. When Mooney arrived, he ran into another shaman who did not allow them to speak since he had begun his isolation. They were, however, allowed to sit outside of his house and speak with him. From this example, it appears as though it was not for hygienic purposes; it was a place away from the harmful elements in the surroundings that Tsiskwa believed may prevent the repair of his spirit.

After identifying the ailment, the priest would place the patient on a strict diet that did not allow hot food, salt, and wood ash lye, among other restrictions (Hudson 344). The patient may also be placed in a winter house where water would be mixed with pounded roots of parsnips and poured over hot

stones to produce a steam bath (Mooney, "History, Myths" 333). The priests may also use rubbing to heal patients. When a patient became ill due to snakebite, for example, the priest rubbed in a left to right circular motion to uncoil the snake, as snakes were believed to coil right to left, thereby releasing the poison. The idea followed the logic that if a person were to uncoil the snake, he or she would uncoil the poison (Hudson 345).

The priests, in the meantime, would go out to the wilderness to collect the specific herbs that would be used to create a concoction to cure the disease. The priest picked only the plants needed to create the medicine and would ask the land for permission and inform it with the purpose of removing the plants. After collecting the herbs, they were taken to a river and tested to see if they would float. If they floated, they could be used for healing. If they did not float, the underworld opposed its use (Hudson 342).

The priests would return to their home and begin to create the medicine. They would take the herbs and place them into a "white washed pot filled with spring water, and put the pot over the fire, praying at the same time to the setting sun...the next morning, the priest prayed...[and] then took some of the water from the pot, in which the herbs had been boiling all night" (Payne 81). Many of the plants chosen had a certain physical correlation with the appearance or need of the patient. For example, the vomiting of bile, a yellow substance, or jaundice was treated with roots, bark, or flowers that were yellow.

Not surprisingly, the priests would name these plants to match the name of the ailment. Cherokee medicine is an empiric development of the fetish idea (Mooney 329). The condition "daloni" (jaundice) originated from the word yellow "dolonigei" and plants that treated this ailment were also called "daloni" (Hudson 342). Mooney highlights that "for a disease caused by the rabbit, the antidote must be called rabbit's food...for snake dreams, the plant utilized is snake's tooth" (Mooney 329). Relationships based on the animal's characteristics could also be used. For example, the turkey buzzard did not symbolize death, because it had the ability to tolerate the presence of dead animals. Consuming the meat of a turkey buzzard, therefore, was believed to provide immunity to illness (129 Hudson).

Although the medicine found in capsules is considered the cure in our society, it would be wrong to the Cherokee to suggest that plants are the effector in curing patients. The application of the medicine does not embody the cure; rather, it is just part of the treatment because "administering medicine...is always connected with charms, incantations, or with sacrifices, prayers, and various acts of devotion" (Payne 79). Mooney believed that

much of the healing power of the Cherokees came from renewed hope of healing originating from the relentless confidence that tribesman had in the priest (Mooney, "History, Myths" 323). The spirit of a person does play a role in the recovery of a person, and the priest could provide the spiritual guidance to expedite healing.

Aside from this belief of the placebo effect, the structure of the formulas was pretty consistent as identified in the Swimmer Manuscript. First, the formula would gain the attention of the spirit with a warning. The spirit would be identified based on color and then the priest would proclaim his power, such as "thou penetratest all things" (Mooney, "Swimmer" 159). The priest would identify the cause of the disease and then call upon a spirit to rid the evil or illness out of the patient's body. The priest would then finish with a statement that relief has been effected and a final exclamation (ya!) to end the ritual. Two examples will show this trend: one for frostbite, and one for snakebite.

#### *Frost Bite:*

*Now then! Ha, now though has come to listen, Brown Rabbit, thou art staying under the (sheltering) broom sedge, moving about. I have come to put my feet under it where it is warm. Relief indeed has been caused. Now then! Ha, now though hast come to listen, Blue Rabbit. Now then! Ha, now thou hast come to listen, Black Rabbit (Mooney, "Swimmer" 258).*

The priest beckons to the rabbit since it was believed to be immune from frostbite. The rabbit lies in a warm place to provide relief to the patient who is suffering from frostbite.

#### *Snake Bite:*

*Now then! Ha, now thou hast come to listen, thou White Fawn Imitator. It was but a snake (which) has advanced its everliving teeth to (bite) him, as it was lying stretched out about the path. The teeth have been broken and made weak. Ha, now Though White Fawn-Imitator, quickly thou hast come to suck it for him. Now then! Ha, now thou hast come to listen, thou White Lizard, thou wizard. It was but a snake (which) has advanced its everliving teeth to (bite) him, as it was lying stretched out about the path. The teeth have been broken and made weak. Ha, now, thou White Lizard, quickly it has been sucked (Mooney, "Swimmer" 241).*

The white fawn imitator, a mythical creature, has the characteristic of striking out its huge tongue, and the notion of using the tongue to lick or suck on the wound explains why this animal is summoned. The other animal, the Lizard, refers to the alligator lizard (*Sceloporus undulatus*) that has the "habit of

puffing out and drawing in its throat, as though sucking, when basking in the sun” (Mooney, “Swimmer” 241). These spirits act in conjunction with the application or process of medicine and play a significant role in Cherokee medicine. These medicine men held direct access to an ill Cherokee’s belief system, and the metaphysical incantations are more significant in healing than the plant oil. These rituals provide patients with hope and faith in healing, two elements that are required if they want to regain their life.

### **Reassessing Cherokee Medicine for Today’s Healthcare**

It is safe to assume that over time, certain plants would be shown to cure specific ailments and would be recognized by the Cherokee as a cure. The Cherokee’s explanations for and understandings of disease may not match the correct scientific reasons for infection or death, but we must realize that even Western medicine not too long ago featured a similar lack of understanding. Medieval physicians also taught that “similia similibus curantur” (likes are cured by likes) and had superstitions not based on scientific reasoning (Mooney, “History, Myths” 329). Charles Hudson gives the Cherokee credit for their invented science and claimed that in some ways certain North American Indians’ cures were far more advanced than Western medicine.

We must also take advantage of the medicine that the Cherokee developed over hundreds of years and help lessen the strain on families who cannot afford the high prices of pharmaceuticals. In order to accomplish this task, basic research on the effectiveness of plant oils on different strains of bacteria and fungi needs to be performed in order to see if the plants contain medicinal benefits. Geranium and goldenseal, two plants used by the Cherokee, have undergone a series of tests to determine their medicinal value. These plant oils speak to the benefits of alternative medicine as they both only cost approximately \$12.00 per 1-ounce bottle<sup>1</sup>, require no prescription, and have claimed antimicrobial and antifungal qualities.

## **METHODS**

**Bacterial Growth Experiments** One ounce bottles of goldenseal and geranium oil were obtained from HerbPharm located in Williams, OR. Luria broth (LB) plates, standard plates for growing bacteria, were created by mixing sterilized, deionized water, Luria broth powder from Fischer Scientific, and agar. The Luria broth solution was sterilized in an autoclave for 15 minutes as directed by the manufacturer. Plates were allowed to dry for 48 hours before *Escherichia*

*coli* (*E.coli*) and *Staphylococcus aureus* (*S. aureus*) were evenly streaked on the respective plates. Blank 5mm discs were then saturated with geranium oil, goldenseal oil, or 50% ethanol (EtOH). 50% EtOH was used as a control because the distillation process of both plant oils used this approximate quantity of EtOH. The saturated discs with their respective solution were then placed onto the infected LB plates. These plates were allowed to grow for 24 hours at the optimal temperature of 37°C and were then photographed. Each zone of inhibition was measured to determine the extent to which the solution prohibited the growth of the bacteria.

**Candida albicans Growth Experiments** The control fluconazole was obtained in pill form from the Moore Health Center at Hampden Sydney College. Fluconazole was dissolved in 25 ml of purified water and purified by a 0.22µm filter. All vials were kept isolated in the lab at room temperature. *Candida albicans* (*C.albicans*) was grown on yeast extract peptone dextrose (YEPD) plates, a media typically used for growing fungi. YEPD plates were made from mixing yeast extract, peptone, dextrose, agar, and sterilized, deionized water. Following autoclave sterilization, the YEPD solution was then mixed with the appropriate concentration of plant oil or EtOH and was then poured into a petridish. YEPD plates were allowed to dry for 48 hours.

Two samples of *C. albicans* were grown in 5.0 ml of YEPD solution for 24 hours at room temperature in a roller drum at 200 RPM. The solution’s density was measured with a spectrophotometer in order to create a consistent density of *C. albicans* cells before beginning the dilution series. After ocular density near 0.200 was obtained, a series of 10 fold dilutions of the new solution was made. 5.0 µL of the original solution and each dilution were placed in a row on the YEPD plates for each sample, resulting in two rows of dilution series. These plates were grown under the ideal temperature of 30°C for 48 hours and were photographed for documentation.

To test for hyphal conversion, *C. albicans* was grown in YEPD solution for 24 hours in the roller drum at 200 RPM. After verifying no contamination had occurred via a microscope, 100µL of *C. albicans* was added to 4.5 mL of YEPD solution and 0.5mL of fetal bovine serum. Eight drops of geranium oil and six drops of goldenseal oil were added to their respective test tubes to test against the control test tubes without oil. These concentrations of plant oil are consistent to the dosage set by the manufacturer. All samples were thoroughly mixed with a vortex. Two sets of each test-tube solution were created in order to grow the *C. albicans* in both 37°C at 120 RPM and room temperature (23°C) at 200 RPM. A 5.00 µL

<sup>1</sup> Retail value obtained from Amazon.com

sample was taken from each test tube after 3 hours and after 24 hours of growing in order to count 400 cells.

**Goldenseal/Geranium Tea Infusion & Gas Chromatography Mass Spectroscopy** To create the tea infusion, goldenseal and geranium plants were obtained from Johnny Seeds in Fairfield, ME and Horizon Herbs LLC in Williams, OR, respectively. These plants were allowed to grow for three weeks in a greenhouse before being uprooted and ground down with a mortar and pestle. The plant remains were then placed in the Soxhlett distillation and was allowed to run to 24 hours to extract any oils out of the plant's root and shoots. The oil-water mixture, or the tea infusion, was then taken and used to test against bacteria.

## RESULTS AND DISCUSSION

### **The Testing of Cherokee Medicinal Plants Goldenseal and Geranium**

In order to determine the efficacy of these two plants, we first tested available commercial grade plant oils to assess their antifungal and antimicrobial characteristics. *Candida albicans* (*C. albicans*), a fungus that causes thrush and urinary tract infections in its pathogenic form, was chosen based on previous accounts of the use of these plants. The pathogenic form can be identified by a long tail-like projection called the hypha (Figure 2). Once subjected to body conditions (98.6°F), the round cells begin to project hyphae. These hyphae allow the fungus to latch onto the interior lining of tissue and create an infection. If the presence of these oils decreases the conversion of this fungus, then these findings may suggest a medicinal cure to thrush or urinary tract infections.

Growth plates and a dilution series was run in order to vary the concentration of *C. albicans*. Plates were allowed two days to grow in an incubator set at the ideal fungal growth temperature of 30°C (86°F). As seen in Figure 3, two different samples of *C. albicans* were used and each adjacent plot to the right is a 10-fold dilution to that of the left. The effects of both geranium and goldenseal oil were observed using the antifungal prescription medicine fluconazole as a control, and both oils showed a strong inhibition in the growth of *C. albicans* (Figure 3). Since the plant oils were isolated with the use of ethanol (EtOH), we also used the same concentration in the control plates (40 and 50 drops of EtOH) in order to ensure the ethanol did not interfere with growth. All concentrations were determined by using the suggested dosage from the manufacturer.

Since the plant oils both showed growth inhibition of *C. albicans*, it is feasible that geranium

and goldenseal oil may also prevent the conversion of the fungus into its pathogenic form. This hypothesis would potentially explain the medicinal mechanism by which the plant oils render *C. albicans* harmless to the human body. In order to test this hypothesis, *C. albicans* was grown in a media for two days. The resulting cells then were transferred into a nutrient growth solution that contained 10% fetal bovine serum. The serum, when heated to the human body temperature of 37°C (98.6°F), replicated the internal conditions of a body and triggers *C. albicans* to become pathogenic. 400 cells were reviewed and counted under a microscope after 3 hours and 24 hours, respectively, of exposure to body conditions. Controls without oil and controls with oil but without the bodily temperature of 37°C growing environment were used.

Both experiments were repeated twice to confirm the findings. As expected, the results in Figure 4 (averages of two experiments) do not show any conversion after 3 hours at room temperature (RT), but once exposed to body conditions of 37°C, the presence of goldenseal and geranium oil both strongly suggest an inhibition of the hyphal conversion of *C. albicans* into its pathogenic form. After 24 hours, the cells exposed to geranium oil exhibited pseudohyphae, a condition in which cells fail to convert into the pathogenic form as seen in Figure 5. The 24-hour results at 37°C show the same inhibition by both geranium and goldenseal oil, but notably there is increased inhibition by geranium from the 3-hour to the 24-hour results. These findings argue that in fact the application of these oils have a beneficial medicinal use in treating ailments caused by *C. albicans* and potentially by other fungi.



**Fig 2.** Comparing *C. albicans* (left) to its pathogenic form (right) featuring hypha



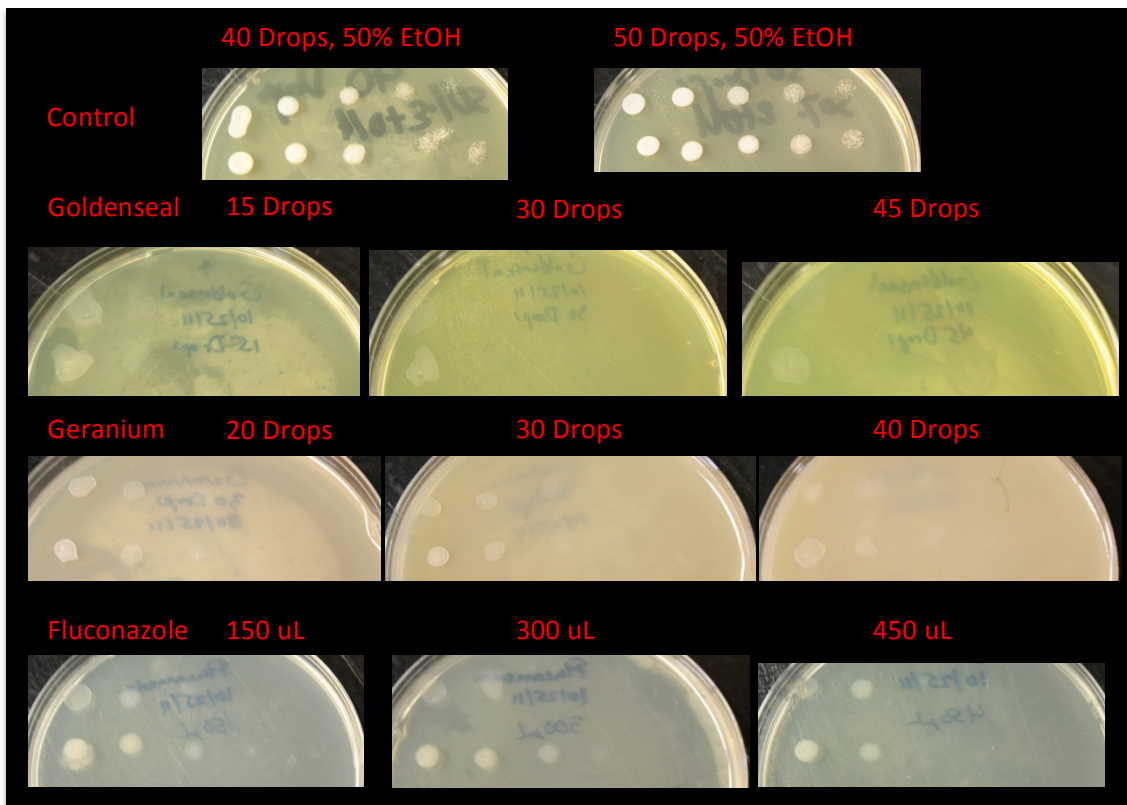


Fig3. *C. albicans* dilution series to test for antifungal properties

**Figure 4. Experimental results from the *C. albicans* hyphal conversion**

3 Hour Results	Control RT	Goldenseal RT	Geranium RT	Control 37C	Goldenseal 37C	Geranium 37C
Normal	197.5	200	200	3	117	54.5
Hyphal	0	0	0	197	83	145.5
Pseudo-hyphal	1.5	0	0	0	0	0
24 Hour Results	Control RT	Goldenseal RT	Geranium RT	Control 37C	Goldenseal 37C	Geranium 37C
Normal	200	200	46	16.5	102.5	96.5
Hyphal	0	0	1	183	97.5	103.5
Pseudo-hyphal	0	0	153	0.5	0	0



Fig 5. Pseudohyphae condition

### **Plant Oil Efficacy Against Two Bacteria Strains**

For testing the inhibition of the plant oils on bacteria growth, we chose two bacteria species, *Staphylococcus aureus* (*S. aureus*) and *Escherichia coli* (*E. coli*), that are likely to be found universally and are known for potential virulence. Growth plates were used to grow lawns of both of these bacteria. Each plate was incubated for at least 12 hours in order to maximize bacterial growth. Then blank discs were used to absorb the plant oils and placed on the plate in a process called disc diffusion. This method is used in order to demonstrate antimicrobial characteristics based on the zone of inhibition (the area of zero growth surrounding the oil-saturated discs) created by the oil-saturated discs. The plates were assessed after 24 hours and the radius of the zone of inhibition, if present, was measured. These plates were compared to controls without any drugs. A disc diffusion of 50% EtOH was also performed to ensure the alcohol present in the commercial oils did not affect bacterial growth. As seen in Figure 6, Goldenseal showed an average inhibition of 3.6 $\pm$ 0.60 mm against *S. aureus* and 5.8 $\pm$ 0.22 mm against *E. coli*. Geranium, which did not have as great of an inhibition as Goldenseal, showed an average inhibition of 1.0 $\pm$ 0.58 and 2.4 $\pm$ 0.61 mm against *S. aureus* and *E. coli* respectively. Although varying, their zones of inhibition suggest that the plant oils have antimicrobial characteristics.

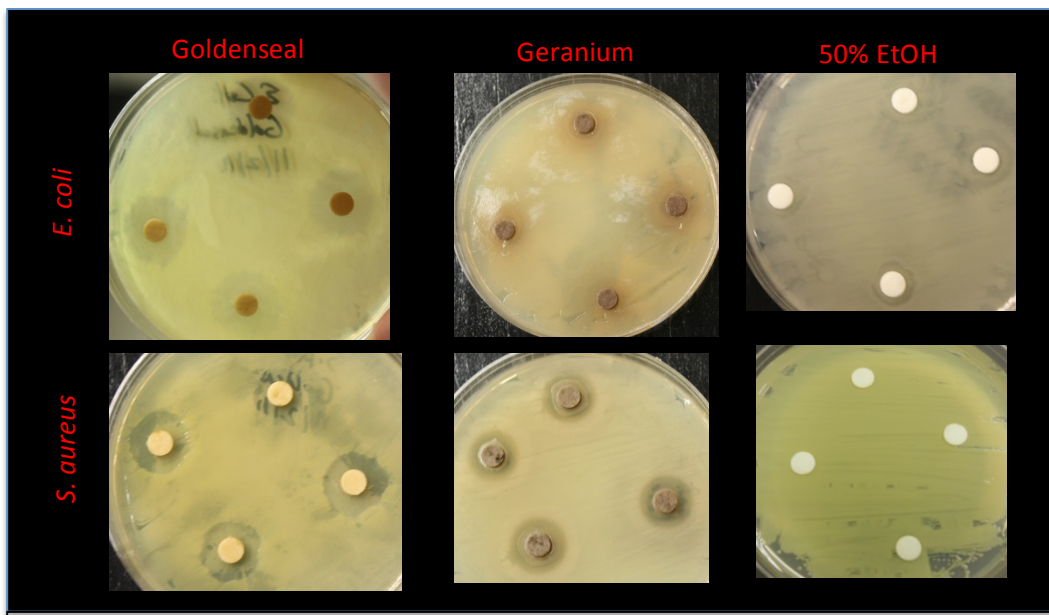
While the plants oils professionally produced have proven effective against bacteria, the Cherokee did not practice the modern techniques used to isolate these oils. In an attempt to reproduce the techniques of the Cherokee, actual goldenseal and geranium plants were obtained and maintained in a greenhouse. Due to cost and availability restrictions, the number and overall size of plants were reduced. The roots and shoots of these plants were then ground using a pestle and mortar and placed into the Soxhlet extractor thimble. The Soxhlet distillation (Figure 7) allows for steam to rise, condense, fall onto the ground roots of the plant and extract oil. The oil-water mixture then recycles into the round bottom flask where the process can be repeated. This created a tea infusion of water and plant oil. We repeated the disc diffusion test with this solution to test for antimicrobial activity. Geranium showed a minimal zone of inhibition in both in *S. aureus* and *E. coli*. However, since we do not know the exact

methods used or the mass of plants needed by the Cherokee to prepare their medicines, we recognize that their medicine might have been more effective than the created tea infusion. Nonetheless, the results from the first bacterial experiment show these plant oils do have antimicrobial characteristics.

### **Berberine: the Yield of Reductionism on Goldenseal**

After observing the effectiveness of goldenseal oil, we checked to learn whether this plant had undergone any pharmacological testing. The last published pharmaceutical study on goldenseal oil, performed by the American Pharmaceutical Association in 1930, gave credit to Native Americans belonging to the Southeast Region of the United States, but goldenseal oil remained "of little importance commercially until introduced to the world by the American Eclectics" (Hirose). Following the introduction of the plant to the Western world in the early 19<sup>th</sup> century, scientists determined that berberine (Figure 8) is the active ingredient in goldenseal.

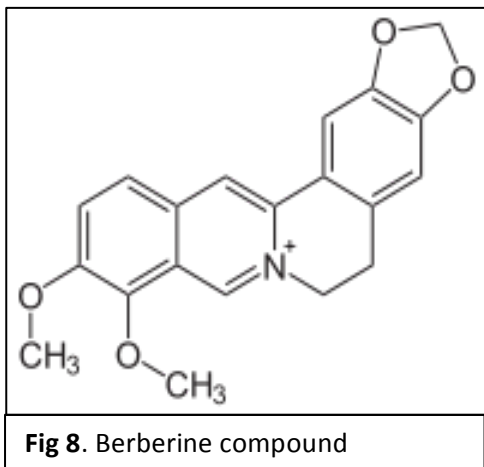
With this in mind, we tested the tea infusion for the presence of berberine in the following. First, we washed the tea infusion produced from goldenseal with methylene chloride. This technique allowed for the removal of any oils from the water so that a gas chromatography mass spectroscopy (GCMS) test could be performed. Once the oil was extracted from the tea infusion, the GCMS provided a spectrum (Figure 9) that showed certain compounds that exist within the solution. Considering prior research on berberine dye, the three noted peaks (195, 162, 135) suggested that one fragmentation of berberine was the compound 1,3-dioxolo[4,5-g]isoquinolin-5(6H)-one,7,8-dihydro- (Ahn, 2009) as seen in Figure 10. The fragment of berberine was found potentially due to the 24-hour distillation process in addition to the mechanism by which GCMS heats and uses electrons to fragment the compound. This fragment strongly suggests that berberine exists in the oil and is the active ingredient in goldenseal.



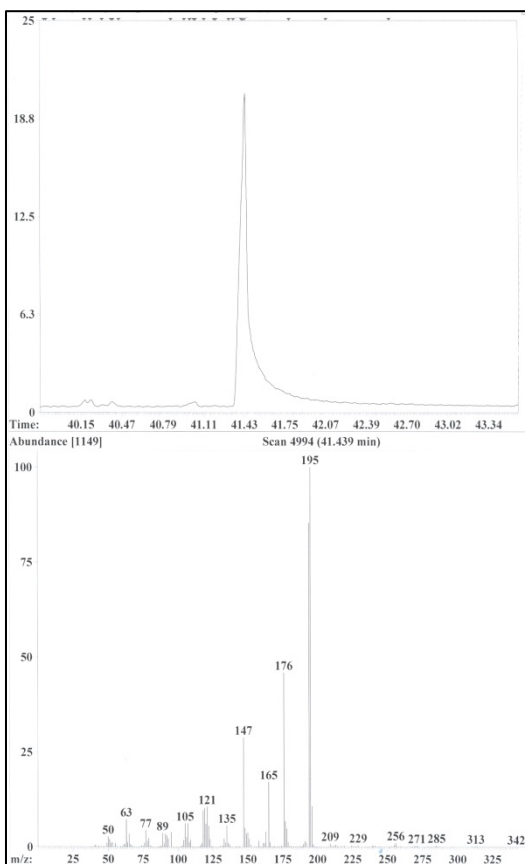
**Fig 6.** Disc diffusion experiment to test antibacterial properties



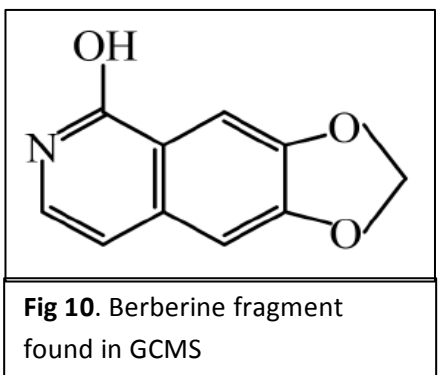
**Fig 7.** Soxhlet distillation apparatus for tea-infusion test



**Fig 8.** Berberine compound



**Fig 9.** GCMS of goldenseal oil



**Fig 10.** Berberine fragment found in GCMS

## CONCLUSION

While Cherokee medicine does not follow the same methodology as we practice today, the primary focus on the health of the spirit rather than on the body and the reliance of natural compounds as medicine garner perspective on how healthcare can be improved today. From a cultural, philosophical perspective, Cherokee medicine demonstrates that the health of an individual heavily depends on the health of the society. The lack of a highly structured belief system and way of life allowed the Cherokee to willingly make choices that proved detrimental to their health as seen by the arrival of the white settlers. The Cherokee example proves that a community must determine what practices they will not tolerate due to their unhealthy or detrimental effect, such as rum or guns, if it plans to eradicate their negative influence on daily life. Modern technology has allowed for the spread of a greater number of influential messages that change the way we perceive the world. The practice of maintaining the health of a community, however, remains important and is one that we pursue as we fight against problems like obesity and illegal drug use. The removal or reduction of unhealthy practices promotes a happier, more satisfied environment for living, ultimately producing a positive change in an individual's quality of life. The practice of the belief that 'I am because we are' by the Cherokee, whether tied by religious beliefs or cultural practices, shows how uniformity can promote good practice towards a healthy lifestyle.

From a scientific perspective, the use of plants like goldenseal and geranium has proven that natural compounds not utilized readily today as medicine have the potential to provide an inexpensive alternative to synthetic prescription medication. Although past work has shown that not all the plants used by the Cherokee were found medically useful (Mooney, "History, Myths", 325), hundreds of years of experimenting by the Cherokee have introduced us to useful compounds like berberine from goldenseal. Ongoing research today on berberine has shown that this compound may be a candidate for prostate cancer therapy as it prevents the growth of cancer cells without affecting the growth of normal prostate epithelial cells (Mantena *et al.*, 2006). Additionally, berberine has also proven to be effective against multidrug-resistant *Staphylococcus aureus* (MRSA), an infection that causes substantial morbidity and mortality in hospitals (Yu, HH, *et. al*, 2005). Without the Cherokee first deciding to use goldenseal, we may never have discovered a compound that has the potential to save lives today. It is these findings that

have led the National Institutes of Health to reconsider other traditional techniques and fund research to investigate if and why these methods like acupuncture are effective ("Acupuncture").

In healthcare today, the obsession to rid a person of a malignant tumor takes precedence over removing the presence of cancer from his or her spirit. The Cherokee believed that the healing of the spirit rather than some medicinal concoction is of utmost importance in the practice of medicine. The calling of nature's forces for help in the rituals performed and the sacredness of the Medicine Man demonstrate that a person must believe in his or her treatment in order to start the healing process. From Cherokee medicine, we learn that healing must be holistic and has to be more extensive than a pill or procedure in order to be truly effective. The benefits of Western medicine and technology must be met with the Cherokee's diligence to care for the patient's spirit/soul as well as the patient's body. The Cherokee and other cultures have provided us with new, beneficial information, but we must incorporate their knowledge into our culture if we aim to improve our practices and our health as a nation.

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