Ergotism: The Satan Loosed in Salem?

Convulsive ergotism may have been a physiological basis for the Salem witchcraft crisis in 1692.

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Numerous hypotheses have been devised to explain the occurrence of the Salem witchcraft trials in 1692, yet a sense of bewilderment and doubt pervades most of the historical perspectives on the subject. The physical afflictions of the accusing girls and the imagery of the testimony offered at the trials seem to defy rational explanation. A large portion of the testimony, therefore, is dismissed as imaginary in foundation. One avenue of understanding that has yet to be sufficiently explored is that a physiological condition, unrecognized at the time, may have been a factor in the Salem incident. Assuming that the content of the court records is basically an honest account of the deponents' experiences, the evidence suggests that convulsive ergotism, a disorder resulting from the ingestion of grain contaminated with ergot, may have initiated the witchcraft delusion.

Suggestions of physical origins of the afflicted girls' behavior have been dismissed without research into the matter. In looking back, the complexity of the psychological and social factors in the community obscured the potential existence of physical pathology, suffered not only by the afflicted children, but also by a number of other community members. The value of such an explanation, however, is clear. Winfield S. Nevins best reveals the implicit uncertainties of contemporary historians (*1; 2*, p. 235).

> . . . I must confess to a measure of doubt as to the moving causes in this terrible tragedy. It seems impossible to believe a tithe of the statements which were made at the trials. And yet it is equally difficult to say that nine out of every ten of the men, women and children who testified upon their oaths, intentionally and wilfully falsified. Nor does it seem possible that they did, or could invent all these marvelous tales; fictions rivaling the imaginative genius of Haggard or Jules Verne.

The possibility of a physiological condition fitting the known circumstances and events would provide a comprehensible framework for understanding the witchcraft delusion in Salem.

Background

Prior to the Salem witchcraft trials, only five executions on the charge of witchcraft are known to have occurred in Massachusetts (*3, 4*). Such trials were held periodically, but the outcomes generally favored the accused. In 1652, a man charged with witchcraft was convicted of simply having told a lie and was fined. Another man, who confessed to talking with the devil, was given counsel and dismissed by the court because of the inconsistencies in his testimony. A bad reputation in the community combined with the accusation of witchcraft did not necessarily insure conviction. The case against John Godfrey of Andover, a notorious character consistently involved in litigation, was dismissed. In fact, soon after the proceedings, Godfrey sued his accusers for defamation and slander and won the case.

The supposed witchcraft at Salem Village was not initially identified as such. In late December 1691, about eight girls, including the niece and daughter of the minister, Samuel Parris, were afflicted with unknown "distempers" (*1, 4–6*). Their behavior was characterized by disorderly speech, odd postures and gestures, and convulsive fits (*7*). Physicians called in to examine the girls could find no explanation for their illness, and in February one doctor suggested the girls might be bewitched. Parris seemed loath to accept this explanation at the time and resorted to private fasting and prayer. At a meeting at Parris's home, ministers from neighboring parishes advised him to "sit still and wait upon the Providence of God to see what time might discover" (*6*, p. 25).

A neighbor, however, took it upon herself to direct Parris's Barbados slave, Tituba, in the concocting of a "witch cake" in order to determine if witchcraft was present. Shortly thereafter, the girls made an accusation of witchcraft against Tituba and two elderly women of general ill repute in Salem Village, Sarah Good and Sarah Osborn. The three women were taken into custody on 29 February 1692. The afflictions of the girls did not cease, and in March they accused Martha Corey and Rebecca Nurse. Both of these women were well respected in the village and were convenanting members of the church. Further accusations by the children followed.

Examinations of the accused were conducted in Salem Village until 11 April by two magistrates from Salem Town. At that time, the examinations were moved from the outlying farming area to the town and were heard by Deputy Governor Danforth and six of the ablest magistrates in the colony, including Samuel Sewall. This council had no authority to try accused witches, however, because the colony had no legal government—a state of affairs that had existed for 2 years. By the time Sir William Phips, the new governor, arrived from England with the charter establishing the government of Massachusetts Bay Colony, the jails as far away from Salem as Boston were crowded with prisoners from Salem awaiting trial. Phips appointed a special Court of Oyer and Terminer, which heard its first case on 2 June. The proceedings resulted in conviction, and the first condemned witch was hanged on 10 June.

Before the next sitting of the court, clergymen in the Boston area were consulted for their opinion on the issues pending. In an answer composed by Cotton Mather, the ministers advised "critical and exquisite caution" and wished "that there may be as little as possible of such noise, company and openness as may too hastily expose them that are examined" (*2*, p. 83). The ministers also concluded that spectral evidence (the appearance of the accused's apparition to an accuser) and the test of touch (the sudden cessation of a fit after being touched by the accused witch) were insufficient evidence for proof of witchcraft.

The court seemed insensitive to the advice of the ministers, and the trials and executions in Salem continued. By 22 September, 19 men and women had been

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sent to the gallows, and one, Giles Corey, had been pressed to death, an ordeal calculated to force him to enter a plea to the court so that he could be tried. The evidence used to obtain the convictions was the test of touch and spectral evidence. The afflicted girls were present at the examinations and trials, often creating such pandemonium that the proceedings were interrupted. The accused witches were, for the most part, persons of good reputation in the community; one was even a former minister in the village. Several notable individuals were "cried out" upon, including John Alden and Lady Phips. All the men and women who were hanged had consistently maintained their innocence; not one confessor to the crime was executed. It had become obvious early in the course of the proceedings that those who confessed would not be executed.

On 17 September 1692, the Court of Oyer and Terminer adjourned the witchcraft trials until 2 November; however, it never met again to try that crime. In January 1693 the Superior Court of Judicature, consisting of the magistrates on the Court of Oyer and Terminer, met. Of 50 indictments handed in to the Superior Court by the grand jury, 20 persons were brought to trial. Three were condemned but never executed and the rest were acquitted. In May Governor Phips ordered a general reprieve, and about 150 accused witches were released. The end of the witchcraft crisis was singularly abrupt (*2, 4, 8*).

Tituba and the Origin Tradition

Repeated attempts to place the occurrences at Salem within a consistent framework have failed. Outright fraud, political factionalism, Freudian psychodynamics, sensation seeking, clinical hysteria, even the existence of witchcraft itself, have been proposed as explanatory devices. The problem is primarily one of complexity. No single explanation can ever account for the delusion; an interaction of them all must be assumed. Combinations of interpretations, however, seem insufficient without some reasonable justification for the initially afflicted girls' behavior. No mental derangement or fraud seems adequate in understanding how eight girls, raised in the soul-searching Puritan tradition, simultaneously exhibited the same symptoms or conspired together for widespread notoriety.

All modern accounts of the beginnings of Salem witchcraft begin with Parris's Barbados slave, Tituba. The tradition is that she instructed the minister's daughter and niece, as well as some other girls in the neighborhood, in magic tricks and incantations at secret meetings held in the parsonage kitchen (*2, 4, 8, 9*). The odd behavior of the girls, whether real or fraudulent, was a consequence of these experiments.

The basis for the tradition seems twofold. In a warning against divination, John Hale wrote in 1702 that he was informed that one afflicted girl had tried to see the future with an egg and glass and subsequently was followed by a "diabolical molestation" and died (*6*). The egg and glass (an improvised crystal ball) was an English method of divination. Hale gives no indication that Tituba was involved, or for that matter, that a group of girls was involved. I have been unable to locate any reference that any of the afflicted girls died prior to Hale's publication.

The other basis for the tradition implicating Tituba seems to be simply the fact that she was from the West Indies. The Puritans believed the American Indians worshiped the devil, most often described as a black man (*4*). Curiously, however, Tituba was not questioned at her examination about activities as a witch in her birthplace. Historians seem bewitched themselves by fantasies of voodoo and black magic in the tropics, and the unfounded supposition that Tituba would inevitably be familiar with malefic arts of the Caribbean has survived.

Calef (*7*) reports that Tituba's confession was obtained under duress. She at first denied knowing the devil and suggested the girls were possessed. Although Tituba ultimately became quite voluble, her confession was rather pedestrian in comparison with the other testimony offered at the examinations and trials. There is no element of West Indian magic, and her descriptions of the black man, the hairy imp, and witches flying through the sky on sticks reflect an elementary acquaintance with the common English superstitions of the time (*9–11*).

Current Interpretations

1) *Fraud.* Various interpretations of the girls' behavior diverge after the discussion of its origins. The currently accepted view is that the children's symptoms of affliction were fraudulent (*4, 8, 12*). The girls may have perpetrated fraud simply to gain notoriety or to protect themselves from punishment by adults as their magic experiments became the topic of rumor (*2*). One author supposes that the accusing girls craved "Dionysiac mysteries" and that some were "no more seriously possessed than a pack of bobby-soxers on the loose" (*8*, p. 29). The major difficulty in accepting the explanation of purposeful fraud is the gravity of the girls' symptoms; all the eyewitness accounts agree to the severity of the affliction (*6, 10, 11, 13*).

Upham (*4*) appears to accept the contemporaneous descriptions and ascribes to the afflicted children the skills of a sophisticated necromancer. He proposes that they were able ventriloquists, highly accomplished actresses, and by "long practice" could "bring the blood to the face, and send it back again" (*4*, vol. 2, p. 395). These abilities and more, he assumes, the girls learned from Tituba. As discussed above, however, there is little evidence that Tituba had any practical knowledge of witchcraft. Most colonists, with the exception of some of the accused and their defenders, did not appear even to consider pretense as an explanation for the girls' behavior. The general conclusion of the New Englanders after the tragedy was that the girls suffered from demonic possession (*2, 6, 9*).

2) *Hysteria.* The advent of psychiatry provided new tools for describing and interpreting the events at Salem. The term hysteria has been used with varying degrees of license (*2, 8, 9, 14*), and the accounts of hysteria always begin in the kitchen with Tituba practicing magic. Starkey (*8*) uses the term in the loosest sense; the girls were hysterical, that is, overexcited, and committed sensational fraud in a community that subsequently fell ill to "mass hysteria." Hansen (*9*) proposes the use of the word in a stricter, clinical sense of being mentally ill. He insists that witchcraft really was practiced in Salem and that several of the executed were practicing witches. The girls' symptoms were psychogenic, occasioned by guilt at practicing fortune-telling at their secret meetings. He states that the mental illness was catching and that the witnesses and majority of the confessors became hysterics as a consequence of their fear of witchcraft. However, if the girls were not practicing divination, and if they did indeed develop true hysteria, then they must all have developed hysteria simultaneously—hardly a credible supposition. Furthermore, previous witchcraft accusations in other Puritan communities in New England had never brought on mass hysteria.

Psychiatric disorder is used in a slightly different sense in the argument that

the witchcraft crisis was a consequence of two party (pro-Parris and anti-Parris) factionalism in Salem Village (*14*). In this account, the girls are unimportant factors in the entire incident. Their behavior "served as a kind of Rorschach test into which adults read their own concerns and expectations" (*14*, p. 30). The difficulty with linking factionalism to the witch trials is that supporters of Parris were also prosecuted while some nonsupporters were among the most vociferous accusers (*2, 14*). Thus, it becomes necessary to resort to projection, transference, individual psychoanalysis, and numerous psychiatric disorders to explain the behavior of the adults in the community who were using the afflicted children as pawns to resolve their own personal and political differences.

Of course, there was fraud and mental illness at Salem. The records clearly indicate both. Some depositions are simply fanciful renditions of local gossip or cases of malice aforethought. There is also testimony based on exaggerations of nightmares and inebriated adventures. However, not all the records are thus accountable.

3) *Physiological explanations*. The possibility that the girls' behavior had a physiological basis has rarely arisen, although the villagers themselves first proposed physical illness as an explanation. Before accusations of witchcraft began, Parris called in a number of physicians (*6, 7*). In an early history of the colony, Thomas Hutchinson wrote that "there are a great number of persons who are willing to suppose the accusers to have been under bodily disorders which affected their imagination" (*12*, vol. 2, p. 47). A modern historian reports a journalist's suggestion that Tituba had been dosing the girls with preparations of jimsonweed, a poisonous plant brought to New England from the West Indies in the early 1600's (*8*, footnote on p. 284). However, because the Puritans identified no physiological cause, later historians have failed to investigate such a possibility.

Ergot

Interest in ergot (*Claviceps purpura*) was generated by epidemics of ergotism that periodically occurred in Europe. Only a few years before the Salem witchcraft trials the first medical scientific report on ergot was made (*15*). Denis Dodart reported the relation between ergotized rye and bread poisoning in a letter to the French Royal Académie des Sciences in 1676. John Ray's mention of ergot in 1677 was the first in English. There is no reference to ergot in the United States before an 1807 letter by Dr. John Stearns recommending powdered ergot sclerotia to a medical colleague as a therapeutic agent in childbirth. Stearns is generally credited with the "discovery" of ergot; certainly his use prompted scientific research on the substance. Until the mid-19th century, however, ergot was not known as a parasitic fungus, but was thought to be sunbaked kernels of grains (*15–17*).

Ergot grows on a large variety of cereal grains—especially rye—in a slightly curved, fusiform shape with sclerotia replacing individual grains on the host plant. The sclerotia contain a large number of potent pharmacologic agents, the ergot alkaloids. One of the most powerful is isoergine (lysergic acid amide). This alkaloid, with 10 percent of the activity of D-LSD (lysergic acid diethylamide), is also found in ololiuqui (morning glory seeds), the ritual hallucinogenic drug used by the Aztecs (*15, 16*).

Warm, damp, rainy springs and summers favor ergot infestation. Summer rye is more prone to the development of the sclerotia than winter rye, and one field may be heavily ergotized while the adjacent field is not. The fungus may dangerously parasitize a crop one year and not reappear again for many years. Contamination of the grain may occur in varying concentrations. Modern agriculturalists advise farmers not to feed their cattle grain containing more than one to three sclerotia per thousand kernels of grain, since ergot has deleterious effects on cattle as well as on humans (*16, 18*).

Ergotism, or long-term ergot poisoning, was once a common condition resulting from eating contaminated rye bread. In some epidemics it appears that females were more liable to the disease than males (*19*). Children and pregnant women are most likely to be affected by the condition, and individual susceptibility varies widely. It takes 2 years for ergot in powdered form to reach 50 percent deterioration, and the effects are cumulative (*18, 20*). There are two types of ergotism—gangrenous and convulsive. As the name implies, gangrenous ergotism is characterized by dry gangrene of the extremities followed by the falling away of the affected portions of the body. The condition occurred in epidemic proportions in the Middle Ages and was known by a number of names, including *ignis sacer*, the holy fire.

Convulsive ergotism is characterized by a number of symptoms. These include crawling sensations in the skin, tingling in the fingers, vertigo, tinnitus aurium, headaches, disturbances in sensation, hallucination, painful muscular contractions leading to epileptiform convulsions, vomiting, and diarrhea (*16, 18, 21*). The involuntary muscular fibers such as the myocardium and gastric and intestinal muscular coat are stimulated. There are mental disturbances such as mania, melancholia, psychosis, and delirium. All of these symptoms are alluded to in the Salem witchcraft records.

Evidence for Ergotism in Salem

It is one thing to suggest convulsive ergot poisoning as an initiating factor in the witchcraft episode, and quite another to generate convincing evidence that it is more than a mere possibility. A jigsaw of details pertinent to growing conditions, the timing of events in Salem, and symptomology must fit together to create a reasonable case. From these details, a picture emerges of a community stricken with an unrecognized physiological disorder affecting their minds as well as their bodies.

1) *Growing conditions*. The common grass along the Atlantic Coast from Virginia to Newfoundland was and is wild rye, a host plant for ergot. Early colonists were dissatisfied with it as forage for their cattle and reported that it often made the cattle ill with unknown diseases (*22*). Presumably, then, ergot grew in the New World before the Puritans arrived. The potential source for infection was already present, regardless of the possibility that it was imported with English rye.

Rye was the most reliable of the Old World grains (*22*) and by the 1640's it was a well-established New England crop. Spring sowing was the rule; the bitter winters made fall sowing less successful. Seed time for the rye was April and the harvesting took place in August (*23*). However, the grain was stored in barns and often waited months before being threshed when the weather turned cold. The timing of Salem events fits this cycle. Threshing probably occurred shortly before Thanksgiving, the only holiday the Puritans observed. The children's symptoms appeared in December 1691. Late the next fall, 1692, the witchcraft crisis ended abruptly and there is no further mention of the girls or anyone else in Salem being afflicted (*4, 9*).

To some degree or another all rye was probably infected with ergot. It is a matter of the extent of infection and the period of time over which the ergot is consumed rather than the mere existence of ergot that determines the potential for ergotism. In his 1807 letter written from

upstate New York, Stearns (*15*, p. 274) advised his medical colleague that, "On examining a granary where rye is stored, you will be able to procure a sufficient quantity [of ergot sclerotia] from among that grain." Agricultural practice had not advanced, even by Stearns's time, to widespread use of methods to clean or eliminate the fungus from the rye crop. In all probability, the infestation of the 1691 summer rye crop was fairly light; not everyone in the village or even in the same families showed symptoms.

Certain climatic conditions, that is, warm, rainy springs and summers, promote heavier than usual fungus infestation. The pattern of the weather in 1691 and 1692 is apparent from brief comments in Samuel Sewall's diary (*24*). Early rains and warm weather in the spring progressed to a hot and stormy summer in 1691. There was a drought the next year, 1692, thus no contamination of the grain that year would be expected.

2) *Localization*. "Rye," continues Stearns (*15*, p. 274), "which grows in low, wet ground yields [ergot] in greatest abundance." Now, one of the most notorious of the accusing children in Salem was Thomas Putnam's 12-year-old daughter, Ann. Her mother also displayed symptoms of the affliction and psychological historians have credited the senior Ann with attempting to resolve her own neurotic complaints through her daughter (*8, 9, 14*). Two other afflicted girls also lived in the Putnam residence. Putnam had inherited one of the largest landholdings in the village. His father's will indicates that a large measure of the land, which was located in the western sector of Salem Village, consisted of swampy meadows (*25*) that were valued farmland to the colonists (*22*). Accordingly, the Putnam farm, and more broadly, the western acreage of Salem Village, may have been an area of contamination. This contention is further substantiated by the pattern of residence of the accusers, the accused, and the defenders of the accused living within the boundaries of Salem Village (Fig. 1). Excluding the afflicted girls, 30 of 32 adult accusers lived in the western section and 12 of the 14 accused witches lived in the eastern section, as did 24 of the 29 defenders (*14*). The general pattern of residence, in combination with the well-documented factionalism of the eastern and western sectors, contributed to the progress of the witchcraft crisis.

The initially afflicted girls show a slightly different residence pattern. Careful examination reveals plausible explanations for contamination in six of the eight cases.

Three of the girls, as mentioned above, lived in the Putnam residence. If this were the source of ergotism, their exposure to ergotized grain would be natural. Two afflicted girls, the daughter and niece of Samuel Parris, lived in the parsonage almost exactly in the center of the village. Their exposure to contaminated grain from western land is also explicable. Two-thirds of Parris's salary was paid in provisions; the villagers were taxed proportionately to their landholding (*4*). Since Putnam was one of the largest landholders and an avid supporter of Parris in the minister's community disagreements, an ample store of ergotized grain would be anticipated in Parris's larder. Putnam was also Parris's closest neighbor with afflicted children in residence.

The three remaining afflicted girls lived outside the village boundaries to the east. One, Elizabeth Hubbard, was a servant in the home of Dr. Griggs. It seems plausible that the doctor, like Parris, had Putnam grain, since Griggs was a professional man, not a farmer. As the only doctor in town, he probably had many occasions to treat Ann Putnam, Sr., a woman known to have much ill health (*2, 4*). Griggs may have traded his services for provisions or bought food from the Putnams.

Another of the afflicted, Sarah Churchill, was a servant in the house of a well-off farmer (*25*). The farm lay along the Wooleston River and may have offered good growing conditions for ergot. It seems probable, however, that Sarah's affliction was a fraud. She did not become involved in the witchcraft persecutions until May, several months after the other girls were afflicted, and she testified in only two cases, the first against her master. One deponent claimed that Sarah later admitted to belying herself and others (*11*).

How Mary Warren, a servant in the Proctor household, would gain access to grain contaminated with ergot is something of a mystery. Proctor had a substantial farm to the southeast of Salem and would have had no need to buy or trade for food. Both he and his wife were accused of witchcraft and condemned. None of the Proctor children showed any sign of the affliction; in fact, three were accused and imprisoned. One document offered as evidence against Proctor indicates that Mary stayed overnight in the village (*11*). How often she stayed or with whom is unknown.

Mary's role in the trials is particularly curious. She began as an afflicted person, was accused of witchcraft by the other afflicted girls, and then became afflicted again. Two depositions filed against her strongly suggest, however, that at least her first affliction may have been a consequence of ergot poisoning.

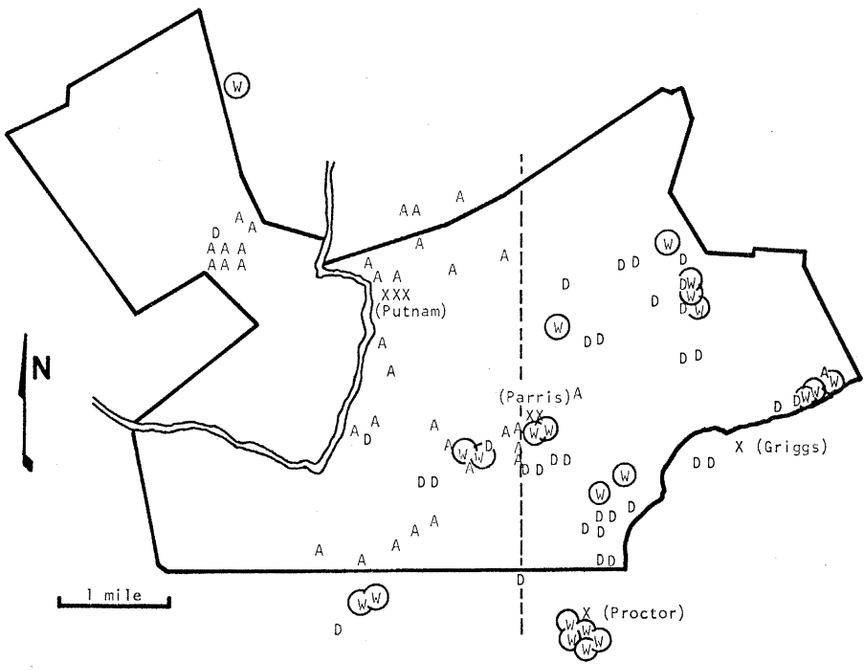

Fig. 1. Residence patterns, Salem Village, 1692. The names in parentheses indicate the households in which the afflicted girls were living, excluding Sarah Churchill, whose affliction is believed to have been fraudulent. The nonvillagers shown on this map are those whose places of residence lay on the fringes of the Village boundaries. Residences are labeled (X), afflicted girl; (*W*), accused witch; (*D*), defender of the accused; and (*A*), accuser. [Adapted from Boyer and Nissenbaum (*14, 25*)]

Four witnesses attested that she believed she had been "distempered" and during the time of her affliction had thought she had seen numerous apparitions. However, when Mary was well again, she could not say that she had seen any specters (*11*). Her second affliction may have been the result of intense pressure during her examination for witchcraft crimes.

Ergotism and the Testimony

The utmost caution is necessary in assessing the physical and mental states of people dead for hundreds of years. Only the sketchiest accounts of their lives remain in public records. In the case of ergot, a substance that affects mental as well as physical states, recognition of the social atmosphere of Salem in early spring 1692 is basic to understanding the directions the crisis took. The Puritans' belief in witchcraft was a totally accepted part of their religious tenets. The malicious workings of Satan and his cohorts were just as real to the early colonists as their belief in God. Yet, the low incidence of witchcraft trials in New England prior to 1692 suggests that the Puritans did not always resort to accusations of black magic to deal with irreconcilable differences or inexplicable events.

The afflicted girls' behavior seemed to be no secret in early spring. Apparently it was the great consternation that some villagers felt that induced Mary Sibley to direct the making of the witch cake of rye meal and the urine of the afflicted. This concoction was fed to a dog, ostensibly in the belief that the dog's subsequent behavior would indicate the action of any malefic magic (*14*). The fate of the dog is unknown; it is quite plausible that it did have convulsions, indicating to the observers that there was witchcraft involved in the girls' afflictions. Thus, the experiments with the witch cake, rather than any magic tricks by Tituba, initiated succeeding events.

The importance of the witch cake incident has generally been overlooked. Parris's denouncement of his neighbor's action is recorded in his church records. He clearly stated that, until the making of the cake, there was no suspicion of witchcraft and no reports of torturing apparitions (*4*). Once a community member had gone "to the Devil for help against the Devil," as Parris put it, the climate for the trials had been established. The afflicted girls, who had made no previous mention of witchcraft, seized upon a cause for their behavior—as did the rest of the community. The girls named three persons as witches and their afflictions thereby became a matter for the legal authorities rather than the medical authorities or the families of the girls.

The trial records indicate numerous interruptions during the proceedings. Outbursts by the afflicted girls describing the activities of invisible specters and "familiars" (agents of the devil in animal form) in the meeting house were common. The girls were often stricken with violent fits that were attributed to torture by apparitions. The spectral evidence of the trials appears to be the hallucinogenic symptoms and perceptual disturbances accompanying ergotism. The convulsions appear to be epileptiform (*6, 13*).

Accusations of choking, pinching, pricking with pins, and biting by the specter of the accused formed the standard testimony of the afflicted in almost all the examinations and trials (*26*). The choking suggests the involvement of the involuntary muscular fibers that is typical of ergot poisoning; the biting, pinching, and pricking may allude to the crawling and tingling sensations under the skin experienced by ergotism victims. Complaints of vomiting and "bowels almost pulled out" are common in the depositions of the accusers. The physical symptoms of the afflicted and many of the other accusers are those induced by convulsive ergot poisoning.

When examined in the light of a physiological hypothesis, the content of so-called delusional testimony, previously dismissed as imaginary by historians, can be reinterpreted as evidence of ergotism. After being choked and strangled by the apparition of a witch sitting on his chest, John Londer testified that a black thing came through the window and stood before his face. "The body of it looked like a monkey, only the feet were like cock's feet, with claws, and the face somewhat more like a man's than a monkey . . . the thing spoke to me . . ." (*25*, p. 45).

Joseph Bayley lived out of town in Newbury. According to Upham (*4*), the Bayleys, en route to Boston, probably spent the night at the Thomas Putnam residence. As the Bayleys left the village, they passed the Proctor house and Joseph reported receiving a "very hard blow" on the chest, but no one was near him. He saw the Proctors, who were imprisoned in Boston at the time, but his wife told him that she saw only a "little maid." He received another blow on the chest, so strong that he dismounted from his horse and subsequently saw a woman coming toward him. His wife told him she saw nothing. When he mounted his horse again, he saw only a cow where he had seen the woman. The rest of Bayley's trip was uneventful, but when he returned home, he was "pinched and nipped by something invisible for some time" (*11*). It is a moot point, of course, what or how much Bayley ate at the Putnams', or that he even really stayed there. Nevertheless, the testimony suggests ergot. Bayley had the crawling sensations in the skin, disturbances in sensations, and muscular contractions symptomatic of ergotism. Apparently his wife had none of the symptoms and Bayley was quite candid in so reporting.

A brief but tantalizing bit of testimony comes from a man who experienced visions that he attributed to the evil eye cast on him by an accused witch. He reported seeing about a dozen "strange things" appear in his chimney in a dark room. They appeared to be something like jelly and quavered with a strange motion. Shortly, they disappeared and a light the size of a hand appeared in the chimney and quivered and shook with an upward motion (*27*). As in Bayley's experience, this man's wife saw nothing. The testimony is strongly reminiscent of the undulating objects and lights reported in experiences induced by LSD (*28*).

By the time the witchcraft episode ended in the late fall 1692, 20 persons had been executed and at least two had died in prison. All the convictions were obtained on the basis of the controversial spectral evidence (*2*). One of the commonly expressed observations about the Salem Village witchcraft episode is that it ended unexpectedly for no apparent reason (*2, 4*). No new circumstances to cast spectral evidence in doubt occurred. Increase Mather's sermon on 3 October 1692, which urged more conclusive evidence than invisible apparitions or the test of touch, was just a stronger reiteration of the clergy's 15 June advice to the court (*2*). The grounds for dismissing the spectral evidence had been consistently brought up by the accused and many of their defenders throughout the examinations. There had always been a strong undercurrent of opposition to the trials and the most vocal individuals were not always accused. In fact, there was virtually no support in the colonies for the trials, even from Boston, only 15 miles away. The most influential clergymen lent their support guardedly at best; most were opposed. The Salem witchcraft episode was an event localized in both time and space.

How far the ergotized grain may have been distributed is impossible to deter-

mine clearly. Salem Village was the source of Salem Town's food supply. It was in the town that the convictions and orders for executions were obtained. Maybe the thought processes of the magistrates, responsible and respected men in the Colony, were altered. In the following years, nearly all of them publicly admitted to errors of judgment (*2*). These posttrial documents are as suggestive as the court proceedings.

In 1696, Samuel Sewall made a public acknowledgment of personal guilt because of the unsafe principles the court followed (*2*). In a public apology, the 12 jurymen stated (*9*, p. 210), "We confess that we ourselves were not capable to understand nor able to withstand the mysterious delusion of the Powers of Darkness and Prince of the Air . . . [we] do hereby declare that we justly fear that we were sadly deluded and mistaken. . . ." John Hale, a minister involved in the trials from the beginning, wrote (*6*, p. 167), "such was the darkness of the day . . . that we walked in the clouds and could not see our way."

Finally, Ann Putnam, Jr., who testified in 21 cases, made a public confession in 1706 (*2*, p. 250).

> I justly fear I have been instrumental with others though ignorantly and unwittingly, to bring upon myself and this land the guilt of innocent blood; though what was said or done by me against any person I can truly and uprightly say before God and man, I did it not for any anger, malice or ill will to any person, for I had no such things against one of them, but what I did was ignorantly, being deluded of Satan.

One Satan in Salem may well have been convulsive ergotism.

Conclusion

One could reasonably ask whether, if ergot was implicated in Salem, it could have been implicated in other witchcraft incidents. The most cursory examination of Old World witchcraft suggests an affirmative answer. The district of Lorraine suffered outbreaks of both ergotism (*15*) and witchcraft persecutions (*4*) periodically throughout the Middle Ages until the 17th century. As late as the 1700's, the clergy of Saxony debated whether convulsive ergotism was symptomatic of disease or demonic possession (*17*). Kittredge (*3*), an authority on English witchcraft, reports what he calls "a typical case" of the early 1600's. The malicious magic of Alice Trevisard, an accused witch, backfired and the witness reported that Alice's hands, fingers, and toes "rotted and consumed away." The sickness sounds suspiciously like gangrenous ergotism. Years later, in 1762, one family in a small English village was stricken with gangrenous ergotism. The Royal Society determined the diagnosis. The head of the family, however, attributed the condition to witchcraft because of the suddenness of the calamity (*29*).

Of course, there can never be hard proof for the presence of ergot in Salem, but a circumstantial case is demonstrable. The growing conditions and the pattern of agricultural practices fit the timing of the 1692 crisis. The physical manifestations of the condition are apparent from the trial records and contemporaneous documents. While the fact of perceptual distortions may have been generated by ergotism, other psychological and sociological factors are not thereby rendered irrelevant; rather, these factors gave substance and meaning to the symptoms. The content of hallucinations and other perceptual disturbances would have been greatly influenced by the state of mind, mood, and expectations of the individual (*30*). Prior to the witch cake episode, there is no clue as to the nature of the girls' hallucinations. Afterward, however, a delusional system, based on witchcraft, was generated to explain the content of the sensory data (*31*, p. 137). Valins and Nisbett (*31*, p. 141), in a discussion of delusional explanations of abnormal sensory data, write, "The intelligence of the particular patient determines the structural coherence and internal consistency of the explanation. The cultural experiences of the patient determine the content—political, religious, or scientific—of the explanation." Without knowledge of ergotism and confronted by convulsions, mental disturbances, and perceptual distortions, the New England Puritans seized upon witchcraft as the best explanation for the phenomena.

References and Notes

1. I have attempted to use sources that would be readily available to any reader. The spelling of quotations from old documents has been modernized to promote clarity.
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3. G. L. Kittredge, *Witchcraft in Old and New England* (Harvard Univ. Press, Cambridge, Mass., 1929).
4. C. W. Upham, *Salem Witchcraft* (Wiggins & Lunt, Boston, 1867; reprinted by Ungar, New York, 1959), vols. 1 and 2.
5. The number of afflicted girls varies between 8 and 12, depending on the history consulted. I have restricted the "afflicted girls" to those eight whose residence in or near Salem Village is known. They are Ann Putnam, Jr., Mary Warren, Mercy Lewis, Sarah Churchill, Betty Parris, Abigail Williams, Elizabeth Hubbard, and Mary Walcott.
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15. F. J. Bove, *The Story of Ergot* (Barger, New York, 1970).
16. A. Hoffer, *Clin. Pharmacol. Ther.* **6**, 183 (1965).
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18. C. E. Sajous and J. W. Hundley, *The Cyclopedia of Medicine* (Davis, Philadelphia, 1937), vol. 5, pp. 412–416.
19. Ergot has been used to induce and hasten labor in childbirth; however, it is generally unsuccessful in procuring abortion. Also, there is no evidence that epidemics of chronic convulsive ergotism of the type hypothesized to have occurred in Salem have produced abortions (*17*).
20. C. M. Gruber, *The Cyclopedia of Medicine, Surgery, Specialties* (Davis, Philadelphia, 1950), vol. 5, pp. 245–248.
21. W. C. Cutting, *Handbook of Pharmacology: Action and Uses of Drugs* (Appleton-Century-Crofts, New York, 1972).
22. L. Carrier, *The Beginnings of Agriculture in America* (McGraw-Hill, New York, 1923).
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24. M. H. Thomas, Ed., *The Diary of Samuel Sewall 1674–1729* (Farrar, Straus & Giroux, New York, 1973).
25. P. Boyer and S. Nissenbaum, Eds., *Salem Village Witchcraft: A Documentary Record of Local Conflict in Colonial New England* (Wadsworth, Belmont, Calif., 1972). The editors publish an extremely useful map adapted from Upham (*4*).
26. A random selection of almost any testimony in Woodard (*11*) will attest to this.
27. Essex County Archives, Salem Witchcraft. Elizer Keysar's testimony from the Thomas F. Madigan photostats as transcribed in the Works Progress Administration verbatim report, vol. 2, p. 9.
28. S. H. Snyder, *Madness and the Brain* (McGraw-Hill, New York, 1974).
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31. S. Valins and R. Nisbett, in *Attribution: Perceiving the Causes of Behavior*, E. Jones *et al.*, Eds. (General Learning Press, Morristown, N.J., 1972).

32. I thank C. F. Paul and M. B. Brewer for their helpful comments on the manuscript.