

**THE CAUSE OF TREMBLES IN CATTLE, SHEEP AND HORSES
AND OF MILK-SICKNESS IN PEOPLE.***

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The mother of Abraham Lincoln died of milk-sickness. In many districts of the region extending from Michigan to Tennessee trembles and milk-sickness proved a veritable scourge to the early settlers. One of these districts was in northern Ohio in the western part of Erie and the eastern part of Sandusky County. Here forty-three persons are said to have died in a single year from this cause. Within the last thirty years Doctor Storey has treated nearly fifty cases in Townsend Township, which may be half of the whole number. The loss of domestic animals from trembles in the three Townships, Townsend, Margaretta and Perkins, since the first settlement, doubtless exceeds five thousand. On some single farms the number is more than a hundred. People who came from Pennsylvania with a view to settling here returned to their own State on learning of the peril of pasturing animals in Ohio. To this day many woods in this district are not pastured, because animals would soon die if turned into them.

Milk-sickness is known to be due to the use of milk, butter, cheese or meat of animals afflicted with the trembles, but what causes the trembles has not been well understood. It has long been known that only the animals allowed to run in the woods were affected, and experience showed that certain woods were very dangerous while others were safe. For a time many thought that the water was the cause of trembles but this idea was discarded long ago, as was also the hypothesis that the air of certain localities furnished the poison. Wm. Morrow Beach, of London, Ohio, in an article on Milk-Sickness in "Transactions of the Ohio Medical Society, 1884," mentions "five separate and distinct classes of advocates as to the causes of the disease," but he seems to have settled on nothing more definite than that the animals contract it by "remaining in the timber over night." Dr. J. A. Kimmell, of Findlay, in an article read at the International Medical Congress, Berlin, 1890, mentions white snake-root among other things supposed to cause the disease but his own belief was that it was of bacterial origin. Dr. Robert Hessler, of Logansport, Indiana, at the meeting of the Indiana Academy of Science, Dec. 1, 1905, exhibited drawings of an apparently new species of yeast he had found in the blood of a horse that had the trembles, and presumed to be the cause. Professor N. S. Townshend was convinced that white snake-root caused the trembles and his articles in the Ohio Agricultural

*Read at the Cincinnati meeting of the Ohio St. Acad. of Sci., Dec. 2, 1905.

Reports for 1858 and 1873 gave evidence to support this view, including a letter from W. J. Vermilya of Ashland County, who in 1856 had produced trembles and death of a mare by feeding her this weed, also a statement that Mr. John Rowe had fed it to cattle in Madison County, 1839, with the same fatal results. W. C. Mills informs me that Professor Townshend and some of his pupils intended to experiment in feeding this weed.

The principal objection to Professor Townshend's view appears to have been that white snake-root grows where animals have been pastured for many years without a single case of trembles and this seemed a serious objection to the theory.

The Eupatoriums are not palatable. Anyone who has tasted boneset will admit that this is true of *Eupatorium perfoliatum*. In the South I have observed that animals leave *Eupatorium serotinum* untouched even where they have been confined so as to eat almost every other green thing in reach. In northern Ohio I have found *Eupatorium ageratoides*, the white snake-root, growing abundantly in a number of woods where animals were pastured but no sign of their having eaten it. But if the pasture becomes poor, some are likely to eat it.

On the 8th of last October I visited a piece of woods in Sandusky County where there was nothing fit for an animal to eat, the principal herbs being nettle, white snake-root, poke and black nightshade, with some clearweed, basil, and bedstraw. Every plant of snake-root had been nipped off so that I did not see one more than about half the normal height. This had probably been done by cattle from the adjoining pasture which were doubtless accustomed to spend a portion of hot sunny days in the shade of the woods. A few weeks before my visit a man and his wife who had been using butter made from milk of cows in this pasture had milk-sickness and the wife died.

Elisha Haff, Townsend Township, Sandusky County, did not think trembles were due to any weed, until he found that western sheep which he turned in his woods ate the white snake-root and died of trembles. Sheep whose ancestors had long been in the region did not eat it and did not have trembles. Since that he has been destroying the weed.

James Fuller in the same township, in 1874, turned sheep into woods when the ground was covered with snow and all they had to eat was this weed. They contracted the trembles and forty of them died. George Sanford in the same township in January, 1881, lost a horse which could get nothing but snake-root in the woods. He tracked it and saw where it had eaten this weed. A number of dogs from the neighborhood fed on the carcass and all died of the trembles.

Mr. H. H. Lockwood of Sandusky, was the first to describe to me the plant which caused trembles and milk-sickness. His

ancestors settled on the peninsula north of Sandusky Bay in 1812. For many years trembles occurred among the stock. He believes that from their own observation they concluded it was caused by their eating snake-root which they would do only in a dry season when the pasture was poor.

About 1872 Mr. David Barber in Margaretta Township, when he was hauling wood with a sleigh, left the gate open into the woods. Sheep got in and, though they were there hardly more than two hours, a number had trembles and some died. The snake-root was the principal plant in these woods. Mr. Barber did not notice that they ate it but supposed at the time that they were poisoned by something they found by pawing through the snow. These woods were notorious for the great number of horses, cattle and sheep which contracted the trembles in them. Mr. Barber told me that he had noticed this weed was abundant wherever trembles prevailed. I had already found this true of the woods I had examined.

In 1904 Louis Quinn had twenty-seven steers pastured in a large woods in Townsend. All had the trembles and nine died. The woods were known to be dangerous and so Mr. Quinn has been accustomed to leave stock there no later than June 1st. This time he left them about a week longer and had more of them than usual so that they were harder pressed for food. In these woods I found white snake-root more abundant than any other dicotyl. I saw thousands of them in a walk of a few minutes while plants fit to eat were scarce. Nearly all the woods in that part of the township are considered unsafe and are pastured only early in the season if at all. In woods near Mr. Quinn's six lambs died of trembles this year. White snake-root was found abundant in all the woods examined in that region with one notable exception. In the woods of Orlando Ransom I could not find a single specimen, though a boy who was assisting me found one. June grass was growing in every part. Mr. Ransom told me the woods had been pastured for the past fifty years and no trembles had occurred. I also learned from several sources that trembles were unknown west of Pickerel Creek which is three miles west of Quinn's woods. I examined woods just east of this creek, but found no snake-root and learned that they were pastured with impunity. West of the creek I could find no snake-root in the first two woods examined, in the third after walking nearly a quarter of a mile I found four or five plants, in the fourth none, and in the fifth many in one place and a few others scattered about.

EARLY EXPERIMENTS IN FEEDING THE WEED.

About 1843 John Palmer Deyo, "a scientific investigator and prominent physician," living near Bellevue fed white snake-root

to a calf which in consequence had the trembles and died. Mrs. S. M. Thomson, a niece of Mrs. Deyo who is still living, remembers that Dr. Deyo took pains to investigate the matter thoroughly at a time when people held conflicting views regarding the cause of trembles and was gratified when his efforts resulted in convincing them that white snake-root was the cause. She thinks that instead of feeding the weed directly to a calf, he fed it to a cow thereby producing trembles in both cow and calf and the death of the latter.

Dr. Cowell, a veterinary physician living near Bloomingville, Erie County, boiled the white snake-root in milk and gave the milk to pigs which soon died of the trembles. He asked another physician, "What ails those pigs?" "Trembles," was the reply. Then he told what he had fed them.

Dr. John Ray who lived at Whitmore, Sandusky County, steeped white snake-root and fed it to a calf which as a result died of the trembles.

I have been told of each of the three cases mentioned above by two old residents, who knew the experimenters personally and all six of my informants are reliable, though of course, they may be in error as to some of the details. There is no doubt that the weed experimented with was the white snake-root and that the experimenters were fully convinced that it was the cause of the trembles.

Mr. William Ramsdell of Bloomingville informs me that about 1842 when there was so much discussion of the subject the boys of the neighborhood used to assemble evenings at the old lime-kiln southeast of Castalia and experiment on dogs. They would boil or steep the white snake-root and putting the extract in milk give it to the dogs, in which it would induce the trembles; a large number were killed in this way. Some one experimented on sheep with the same result. He informs me also that a Mr. Redmond (who did not believe that the weed was the cause of trembles) chewed some of the weed and died after suffering for about four weeks.

About 1840 Thomas James of Bloomingville caused a calf to die of trembles by feeding it a weed he brought from the woods, which from the description given me by his daughter and also by Isaac Jarrett, I concluded was white snake-root.

Dr. Carpenter of Castalia, and B. F. Dwelle of Ottawa County, also experimented in feeding this weed and were convinced that it was the cause of the trembles.

RECENT EXPERIMENTS.

Cats.

No. 1. On November 26th my pupil, Oscar Kubach, using snake-root I had recently gathered, broke up the stems and

leaves of two plants (possibly 3 or 4?) and soaked them over night in about a pint of milk, of which he gave about a gill at about 9 A. M. to his tom-cat. The cat took about one-half of it.

"About 9:30 it seemed to take effect and he tried very hard to vomit but could not. He took long, deep breaths. He was quiet and wanted to sleep very hard. All of a sudden he would tremble very hard, then again very little. A watery fluid passed from his eyes and mouth. He chose a spot in the sun and when driven away walked back in a staggering manner. He had no appetite. His senses seemed to be duller, as he did not care for anything. He went to sleep about 10:30 but did not sleep sound. He seemed to be in an unconscious state for the rest of the day. The next morning about 10:30 he walked about three rods and there died about noon."

Oscar lives in the country and I did not see the cat until he brought it to me dead. Weight estimated $4\frac{1}{2}$ pounds. Post-mortem examination by Dr. H. C. Schoepfle and myself showed no lesion, inflammation, congestion or unnatural appearance of any organ. Brain not examined. Death followed more quickly in this case than in any of our other experiments. The cat was not fed the evening before giving the poisoned milk, so that digestion was probably rapid. As it was not taken from home and so was not kept in confinement, the case is especially interesting.

No. 2. A female kitten weighing after death thirty ounces, had probably never been handled by anyone until caught for this experiment. My pupil, Alton Fuchs, cut up about half a pound of snake-root I had gathered and boiled it about an hour in a quart of water. When the water had become reduced to a syrupy liquid, about one tablespoonful in volume, it was poured into the throat of the cat and the outside of the throat tickled so that it was all swallowed. "Soon after the decoction was administered the cat acted as if she wanted to vomit but did not vomit at any time. When first turned loose in room of barn it was very active, but after half an hour seemed rather stupid. After an hour she escaped, but was caught while trying to get through a fence, being less active than before poisoning." I first saw her about $2\frac{1}{2}$ hours after extract was given, lying in natural position, eyes directed toward us, but rather dull, took notice of anything held near but indisposed to move. Respirations 38 and 36 per minute, doubtless increased by our presence. Movement of the back seemed greater than in normal breathing, and occasionally a spasmodic contraction ran along the muscles of the back. About noon the next day she took some milk. The symptoms continued much the same as the previous day, the spasms more frequent and pronounced, becoming worse in the

evening, when at times two or three in close succession made a sort of trembling. Much duller than the evening before but would still move, if driven.

At 8 the next morning she shook all over, her head moving from side to side and the spasms continuing. At some of our visits that day we did not see real trembling. She took some milk and could still climb but showed weakness. At 5 P. M. the breathing was slow and barely discernible. The next morning, Nov. 29, she had taken some milk containing extract of snake-root that had been boiled $1\frac{3}{4}$ hours. Breathing deep but of normal rate—about 21 per minute. No trembling until after she was made to exercise. At 11:40 A. M. more trembling and violent paroxysms. At 12:30 Alton held her by the nape of the neck with her back resting in his other hand so that the legs were free. They quivered rapidly, continually and very plainly, the trembling being intensified by bending the legs with the hand.

At 3:40 on being held the same way, trembling did not show at first but soon became plain in one hind leg and then in both. Rectal temperature $101\frac{1}{4}$, the same also on Dec. 4, when the legs would still tremble somewhat but the eyes were normal, appetite good and she was active and restless. She had become tame and even familiar. No extract had been offered Nov. 30th and after that she would take no milk with it in, though her appetite was good. When held up some trembling could be seen, mostly in hind legs, as late as Dec. 7th, though in other respects she seemed well. She disappeared for a time and after her return showed no more trembling or effect of the poison except that she was entirely tame. She had at no time been given any of the snake-root except thoroughly boiled extract.

Dec. 14. The same cat was brought to me for further experiments. She showed no trembling or anything abnormal, took milk readily. The next morning I offered her milk in which snake-root had soaked. She would not drink it although it had been warmed and it was left with her about two hours. At 10 o'clock I gave her the heart, lungs, neck and back of thoracic region of a rabbit which had weighed 24 ounces and had died of trembles. She began eating it at once. At 11:30 she had eaten all and apparently wanted more. At 4:15 she seemed eager for food but would not take milk in which snake-root had been soaked, but ate the meat offered—half of liver, part of abdominal muscle and head of same rabbit. No trembling that day, but not examined after 4:15.

At 8:10 the next morning when lifted by nape of neck, hind legs trembled strongly and on a second trial, the right fore leg also (and the left a little?). When let out of box she found remains of the rabbit up on a window sill and ate part of the stomach which was filled with snake-root and parts of other

viscera, including some liver, and might have eaten much more, if permitted. At 9 A. M. still trembled, but not so much; at 10:45 could see no trembling; at 4 P. M. very little trembling when held up until after exercise when it was plain. Dec. 17, temperature at 9:10 A. M., 103°, at 3:30 P. M., 103.2°. Trembling; at 9:10, none; at 10 o'clock, after considerable exercise, hind legs trembled and after drinking milk (she would take none with snake-root in it), the hind legs and right front leg trembled strongly when she was held up; at 3:30 trembling mostly in left hind leg and that not till she had been held some seconds. She continued active and appetite good. Killed Dec. 17, but not examined until Dec. 26, when the only abnormal appearance was a general venous engorgement (likely due to the CS₂ which killed her?). The experiments with this cat proved that trembles could be produced by thoroughly boiled extract of snake-root. The later experiments showed that she would no longer take milk containing the poison but would take meat greedily, also that this meat brought on the trembling again, but her first experience appeared to have effected some degree of tolerance of the poison, for she was not so strongly affected as a larger cat which ate a smaller quantity of meat from the same rabbit. This was

No. 3. A female cat, weight about $3\frac{3}{4}$ pounds; was fed like No. 2 with meat from rabbit, No. 6. A hind leg was given at 8 A. M., Dec. 14, but at 3:40 P. M. had not been eaten. At 7:50 the next morning she had taken this and some good milk. A fore leg and side were put in, but had not been eaten at 10 o'clock. At 4:10 P. M. the larger part had been eaten. No trembling that day. At 5:50 P. M. left her half of liver.

Of this piece about one-third remained the next morning and was given to No. 2, which had eaten other half of liver. After being out of box a few minutes she returned voluntarily. Then, for the first time I could feel trembling and on holding her up could see strong trembling of hind legs. 9 A. M., trembled some; at 10:45 did not tremble, had not eaten much of the meat left earlier, drank good cold milk and a few minutes later, when I held her up she trembled so that I could feel it and see it in her legs, three or four of them; 4 P. M., trembled some and, after a very little exercise, strongly. On putting her on window sill, 3rd floor, and letting her look out, trembling was quite noticeable even without holding up. After being let free on the floor a little while trembling was very strong; apparently indisposed to exercise. When returned to box began eating rabbit.

Dec. 17, 8:50 A. M., rabbit meat consumed except large intestine containing snake-root. She seemed no worse; respirations 40 and 36 per minute, doubtless increased by fear; temperature at 9:45 A. M., $101\frac{3}{4}$ °; trembling that day no greater than

preceding. Dec. 18, less trembling than before. At 4 P. M. put in the whole of rabbit No. 7 of which we had made post mortem examination. She began eating it at once. Though the rabbit weighed 24 ounces she had at 8 o'clock the next morning eaten the greater part and seemed satisfied after such a hearty meal. All day she seemed to feel good and did not usually tremble except after exercise or drinking cold milk, when the trembling was very strong. More active than previously, had ceased to show much fear. The next morning she had taken the rest of the meat, the parts remaining being the skull, hind leg bones, considerable of the skin and the large intestine containing snake-root. She seemed no worse. Next day, Dec. 21st, 7:20 A. M., no trembling till after some exercise; temperature 102.9°. At 4:40 P. M. no trembling could be seen. She seemed entirely well. I began to wonder if eating second rabbit would have any effect. That day I offered her milk in which snake-root had been soaked but she took very little of it.

Dec. 22nd, she seemed pretty well and was put in a shed from which she escaped and I did not expect to see her again, nor care, as I had seen no reason to suppose she would show anything more of interest. She was not gone long, however, but adopted the shed for her home, spending most of the time in a basket with a flannel cloth in the bottom and paper under the handle partly covering her and helping to keep her warm. She evidently had not got rid of the rabbit and it was making her trouble. Constipation, though not complete, seemed to continue as long as she lived. The hind legs were spread apart more and more each day. She was allowed to go and come as she pleased and for a number of days I thought she would recover. On Dec. 28, she caught sight of a rabbit I had left on the grass and started to rush at it, being restrained with difficulty.

Meat and milk were kept by her much of the time but she took little or nothing except water and a little cooked potato at any time after Dec. 22nd. Dec. 30, she had been going about so much that I thought she was nearly well, but at 4:30 I found her temperature 103.9°, buttocks soiled, odor very bad. When held up by nape, hind legs trembled. After this I think she did not leave the shed but grew weaker, sometimes trembled when held up, at other times not. Jan. 2nd, she seemed too weak to tremble, had barely energy enough to crawl back into basket when put down near it. At 12:30 I noticed paroxysms of muscles about the shoulders. At 4 o'clock she seemed nearly dead, no struggling but quiet. At 5 she was getting cold. The next afternoon I opened the abdominal cavity and found two ounces or more of a perfectly clear amber colored liquid of slight acid reaction. No inflammation or congestion.

(To be continued.)