

## A Malaria Epidemic of Terre Haute and Vicinity in 1938, 1939, 1940

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**Introduction.** The reappearance of malaria in epidemic form in Terre Haute and vicinity after an absence of half a century or more is of interest because: first, it has been spontaneous in its reappearance; second, it has persisted through the years 1938, 1939, and 1940; third, it has again reached as far north as Terre Haute after it has been confined to a more southern habitat.

Malaria probably has always been endemic in Terre Haute but for years it has been taught in hygiene classes in several colleges of the state that malaria had been exterminated from Indiana.

**Brief History.** The name of the city Terre Haute means high land because it is located on a high terrace on the east bank of the Wabash River. An Indian village was located on this terrace during early historic times before the white man settled in that region. The Indians found this location a healthful place compared to locations up or down the river or to locations across the river. When the white man came to the same region he also picked this comparatively healthful place to camp and later to live.

As the city increased in size and spread up and down the eastern bank and toward the level plains to the east, the white man began to encroach upon less healthful territory. The terrace is less pronounced as you travel a few city blocks north or south and the river may even overflow its banks into low lands where, when it recedes it may leave ponds, swamps, and pools of a more or less permanent nature. Toward the east, the prairie contained ponds, sluggish streams and swamps. By 1840-1850 this became an ideal place for the spread of the malarial parasite.

In conversing with W. O. Patton, age 90 years, I found that he recalls that in 1857 his family moved to Terre Haute from Ohio. Immediately upon arrival the whole family developed "chills" and "fever" which persisted for a period of three or four years. He recalls that everyone habitually took quinine by the teaspoonfuls, that people were often yellow in the late summer and fall and had to take greater quantities of quinine. As sewers were built and streams, ponds, and swamps were drained conditions improved so that by the turn of the century malaria definitely decreased and we know that it practically disappeared in the next few years.

**The Epidemic of 1938, 1939, 1940.** The estimated cases of malaria for 1938, 1939, 1940 were 1,084, 165, and 22, respectively.<sup>1</sup>

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<sup>1</sup> I am indebted to E. T. Zaring, M.D., Secretary to the Terre Haute City Board of Health, for the estimated number of cases.

I feel sure that the number is underestimated rather than overestimated for it is a tradition for people to treat themselves with quinine for the "chills." The above estimate consists of the actual cases treated by physicians. However, only a fraction of the above was actually examined by means of blood smears, but a large enough sample was done to prove that the epidemic was actual and not imaginary. Fifteen to twenty blood smears, taken from as many different people, were stained with Wrights stain and examined. They were identified, by myself, and verified by Dr. L. T. Coggeshall, of the Rockefeller Foundation for Medical Research, as *Plasmodium vivax*. Three death certificates giving malaria as the cause of death were each followed up to see what the history of the cases were. The three cases were hospital cases. Two occurred this year (1940) and one last year (1939). I could find out little about the case last year except it was an old man.

Of the two cases occurring in 1940, one was a small boy two to four years of age and the other a woman of thirty-six years of age. Both cases were of short duration. The child upon being taken to the hospital was examined by the physician one day and died before he was seen the next day. The woman was a surgical case and was progressing well until two or three days after the operation she developed a very high temperature. The physician looked for post operative infection, even opened up the incision and found no pus. When a leucopenia was found and a blood smear examined the asexual schizonts were found in very large numbers. The patient died within thirty-six to forty-eight hours after the temperature began to climb. At one time the temperature reached 107° F. The patient died of cerebral symptoms. The physician says that the history of this case shows malaria the year before treated by a course of atabrine, and seeming recovery.

These three fatal cases may have been *Vivax falciparum*, and the malignancy of the disease would lead one to suspect it, but I was unable to get a blood smear for examination.

There were many typical and atypical cases. Many persons were inadequately treated and many self treated with proprietary remedies as well as quinine. Some strains of parasites were harder to kill than others and recurrences of the disease occurred the same year or succeeding years. A nurse who was treated two successive years by as many physicians, finally treated herself with large quantities of atabrine and plasmochin until she developed a splenitis, again took the disease the following year (1940), was treated by a third physician and is believed cured.

A druggist, inadequately treated with quinine, and who had several recurrences of the disease finally "cured" himself with plasmochin. Why this was so I do not know, for plasmochin is not a schizonticide.

A professor of Indiana State Teachers College, on the other hand, cured himself of a very severe case of "chills" by five days treatment with atabrine.

The medication as given by most physicians in Terre Haute is as follows:

Quinine—5 grains 4 times a day. Total 20 grains daily for five days.

Atabrine—1½ grains 3 times a day for five days.

Atabrine or quinine taken for five days followed by plasmochin ½ grain three times a day for five days.

For the benefit of those who do not know the new synthesized drugs mentioned, I will briefly explain:

Quinine—derived from cinchona bark, usually a sulphate salt, a schizonticide.<sup>2</sup>

Atabrine—a synthetic dye and a schizonticide.

Plasmochin—a synthetic drug and a gametocide.

Rhodoquine—a French product and a homologue of plasmochin.

**Conditions Leading Up to the Epidemic.** In 1938 the stage seems to have been well set for an epidemic of malaria. In the first place the rainfall in the spring and summer of 1938 was very heavy. The U. S. Weather Bureau located in Terre Haute gives the total rainfall for the months of June, July, August and September of 1938, 1939, and 1940 as in Table 1.

TABLE I.

	1938	1939	1940
June .....	4.32 inches	6.16 inches	2.99 inches
July .....	4.86 inches	4.38 inches	2.25 inches
August .....	10.03 inches	3.57 inches	2.72 inches
September .....	1.50 inches	1.17 inches	.96 inches
Total .....	20.71 inches	15.28 inches	8.92 inches

Furthermore, the flood stage of the river occurred many times during 1938, and fewer times in 1939, lasting several days or weeks each time. I did not analyze this factor completely except to note that peaks of the floods were reached on the dates as set out in Table 2. The flood stage of the river is 14 feet.

TABLE II.

1938	1939	1940
Feb. 21 .... 14.6 ft.	Feb. 21 .... 14.0 ft.	Never reached flood stage
Feb. 25 .... 15.7 ft.	Feb. 26 .... 16.5 ft.	Highest point
Mar. 17. .... 14.5 ft.	Mar. 16-22 .. 24.8 ft.	Mar. .... 13.1 ft.
Mar. 22. .... 17.5 ft.		Apr. .... 11.9 ft.
Apr. 13 .... 21.7 ft.	Apr. 22 .... 22.0 ft.	
July 1-9 .... 20.7 ft.	June 20 .... 14.1 ft.	

NOTE: Flood stage of Wabash River at Terre Haute is 14 feet.

There is much seepage of water below the 14-foot stage and much backwater at the flood stage. See Table 2. There are large natural basins for this water west of the river and a few places even east of the river.

<sup>2</sup> It is interesting and alarming to note in this respect that the United States is importing large quantities of quinine from Dutch West Indies and if war comes in the Pacific the problem of malaria may become a serious one in Indiana as well as in the rest of the United States.

These basins serve as natural breeding places for mosquitoes. The prevailing westerly winds or an unusual north wind would blow mosquitoes, if present, toward the city.

In the second place, it is worth observing that a fad for fishpools and rock gardens reached a peak during the year 1938, so that more places were present for mosquito breeding.

Furthermore, it had been a matter of observation and comment and can be taken for what it is worth that the U. S. Government began the building of levees along the river which may or may not be a hindrance to drainage of surface water, seepage and overflow of levees which occurred in 1938 near West Terre Haute.

No doubt, also, new strains of malaria were brought in by human hosts. Travelers to Florida could and did, as I know specifically, return with malaria. It is also a matter of conjecture that inadequately treated paresis cases treated with malaria may have spread the disease.

### Summary

1. Terre Haute and vicinity suffered a spontaneous malaria epidemic of fair magnitude during the years 1938, 1939, 1940.

2. A survey of the laboratories and physicians showed that more than a thousand cases occurred in 1938 at the peak of the epidemic.

3. Three deaths occurred during the epidemic and were of a cerebral type. Blood smears of these cases were not seen by the author and so were not specifically identified—probably due to malignant form *Plasmodium falciparum*.

4. Fifteen or twenty blood smears examined by the author and verified by the Rockefeller Foundation for Medical Research were identified as *Plasmodium vivax*.

5. The mosquito involved was the common *Anopheles quadrimaculatus*; further work may disclose the presence of other species.

6. Heavy rainfall of 1938 and 1939 plus decreased drainage and increased number of artificial pools made perfect conditions for the increased breeding of mosquitoes.

7. Human carriers of malaria have brought malaria from the Southern States to Indiana. It is also probable that persons treated for paresis by malaria and inadequately treated for the latter disease spread malaria.