Some personal observations made in Pennsylvania and in Texas regarding malarial fever and the anopheles mosquito / by Albert Woldert, M.D., of Tyler, Texas.

[Reprinted from *American Medicine*, Vol. XI, No. 12, pages 423-427, March 24, 1906.]

SOME PERSONAL OBSERVATIONS MADE IN PENNSYLVANIA AND IN TEXAS REGARDING MALARIAL FEVER AND THE ANOPHELES MOSQUITO.*

BY

ALBERT WOLDERT, M.D.,

of Tyler, Texas.

Malarial fever is an acute, infectious, inoculable disease, sporadic, epidemic, and endemic. It may occur during all seasons of the year. It is due to one cause only—the plasmodium of malaria. As all know, this microorganism was discovered by Dr. Alphonse Laveran in November, 1880. At that time he was in the French military service, working in Constantine, Algeria, but is now teaching in the medical school at Val de Grace, near Paris, France.

The malarial parasite is an animal organism belonging to the natural order *Gymnosporidia*, class sporozoa, and is divided into different species, namely, hemameba malaria (quartan), hemameba vivax (tertian), and hæmomenas præcox (Ross), or, according to others, *Laverania malariæ*, causing the pernicious or remittent forms of fever, such as the estivoautumnal fever.

Malarial parasites may contain either male or female elements. The life-history of this animal parasite is an intricate process, subject to many difficulties which hinder the perpetuation of its species.

So well does it guard its own means of self-preservation that it has chosen two hosts in which to complete its life cycle, which is to grow, to sporulate, and to propagate its offspring. In this respect its mode of

* An address (by invitation) made before the McLennan County Medical Society and Business Men's Club, Waco, Texas, September 12, 1905.

existence differs materially from many of the known infectious microorganisms.

It has been absolutely proved that the malarial parasite undergoes two distinct and totally different cycles of development, one occurring in the blood of man, the other in the middle intestine (or stomach) of the genus *Anopheles*. In man the first stage in the life cycle is represented by a small hyalin intracorpuscular body about a twentieth the size of a red blood-corpuscle and has a rapidly dancing ameboid movement. Within from one to three days this hyalin body will have grown to be three-quarters to the full size of a red blood-corpuscle, and in its interior it will be seen to have accumulated certain minute black pigment granules, which are being lashed about in all directions. After a while this same parasite will be observed to undergo a subdivision into numerous segments and to sporulate into round hyalin bodies, which then reenter other red blood-corpuscles.

The development of the germ of malarial fever in the body of the mosquito (*Anopheles*) is an entirely different process from that which occurs in the blood of man. When the malarial parasite is withdrawn from the circulation and allowed to stand for about 20 minutes upon a warm stage of the microscope flagellated parasites develop, and this is the same process which the parasite undergoes when it has been swallowed by the mosquito—flagellæ develop from the full-grown parasites. Some of the full-grown parasites which have been swallowed by the *Anopheles* do not develop flagellæ and into these bodies certain detached flagellæ enter, with the result that a certain kind of fertilization occurs and after a short interval flagellæ do develop and these fertilized flagellated bodies are then endowed with the faculty of burrowing their way through the muscular layer of the mosquito's intestine (or stomach) and in the outer layer form small cysts or zygotes projecting into the abdominal cavity of this insect and looking like excrescences or warts. Within

from seven to ten days these same öocytes or zygotes develop in the interior many hundreds of small spindle-shaped *spores or sporozoites* of malarial fever and later these zygotes become so distended by the great number of spores that they rupture in much the same way as does the mother tick when it is filled with seed-ticks. These spores on becoming free in the abdominal cavity of the mosquito will then be washed upward into the salivary glands of the mosquito to be poured out with the saliva into the blood of man the moment the insect bites, and each of these spindle-shaped spores (in the mosquito) will in man become converted into the small intracorpuscular hyalin bodies and within 2 to 21 days give rise to chills.

It should be remembered that the mosquito does not possess a heart nor a closed system of bloodvessels,[1] but that the blood (which is white in color) flows freely throughout its entire system, being propelled along the back by what is known as the dorsal vein, a mere tube open at both ends and which contracts and expands with each pulsation, so that it is an easy matter for the spores of the malarial parasite, or spores of other disease-producing microorganisms, to be distributed throughout the entire body of the mosquito. Therefore, in an infected *Anopheles* the spores are not all washed into the salivary glands under the insect's neck, but may be found in all parts of its body. One may readily understand how easy it would be for such an infinitesimal body as the spores of this malarial parasite to be distributed throughout the body of the mosquito when they will recall that fully developed parasites as *Filaria sanguinis hominis* have been found after dissection in different parts of the body of the mosquito, including the salivary glands.

Just why one special kind of mosquito can act as the definitive host for the malarial parasites, while another genus does not seem to be able to do so, depends perhaps upon certain anatomic peculiarities and upon the nature of the tissue juices in certain types of mosqui-

tos. Nearly every step of the different processes mentioned has been closely followed by different investigators, including myself, and there is hardly one word of what may be called "theory" in it. Each step has been proved to be a demonstrated fact. One who holds to any other belief is a "theorist," because he has proved nothing. In a number of instances infected mosquitos have been allowed to bite man with the result that within a few days such persons have fallen ill of malarial fever and of the identical type of fever as those from whom the parasites were derived. In one such instance infected mosquitos were allowed to bite an individual in one of the hospitals of Rome and were placed inside of netting and carried to London, a distance of over a thousand miles, and these infected mosquitos were then permitted to bite the son of Dr. Patrick Manson, with the result that within 10 days he developed the same type of malarial fever as that which afflicted the patient in Italy. Sometimes we hear of writers speaking of the mosquito as "stinging" a person. The mosquito does not sting—it *bites*. The mouth parts of the mosquito consist of an epipharynx or labrum; two mandibles for piercing tissues; two maxillas or jaws; and a hypopharynx. These parts when not in use are enclosed within a scale-covered sheath called the labrum.

PERIOD OF INCUBATION OF THE DIFFERENT FORMS OF MALARIAL FEVERS.

By experiments very carefully performed Marchiafava, Bignami, Grassi, Ross, and Koch have worked out the period of incubation of each of the varieties of malarial fever. Thus for the tertian fever the maximum period of incubation is 21 days, the minimum 6 days, or a general average of 11 days; for quartan the maximum period of incubation is 21 days, the minimum 11 days, or a general average of 14 days; and for estivo-autumnal the maximum period of incubation is 14 days,

the minimum 2 days, or a general average of 6 days. As stated, the development of the malarial parasite inside the mosquito from the flagellated parasite (and vermicule) to the spore stage is fraught with many adverse circumstances and dangers. Thus the parasite develops best at a temperature of about 85° F. and not at all below 65° F. The malarial parasite could not therefore develop in the arctic zone or where the temperature was constantly below the freezing point unless the infected mosquito hibernated in a warm atmosphere. But a patient in whom the malarial parasite lies dormant might be taken to the North Pole and be subject to chills even though there were no mosquitos.

If we consider the life cycle and the method adopted by different types of microorganisms to perpetuate its species, as for instance the micrococci, we will find that they multiply by fission. In other words, there is a cleavage along certain lines and one microorganism splits off into two microorganisms, thus producing the diplococci. Sometimes the cleavage occurs in three directions and sarcina are produced. If the cleavage always occurs in the same direction we have long chains of organisms and these are called streptococci, and if into groups the staphylococci. It will be remembered that the bacilli always divide by transverse fission, thus arranging themselves into distinct threads, some of which contain spores, such as the bacillus of tetanus, the the bacillus of anthrax, etc.

The bacillus of bubonic plague and the bacillus of tetanus, as we all know, may grow and develop in the soil, but when one considers how simple the method of reproduction this is as compared with that of the higher type of microorganism such as the malarial parasite one can clearly comprehend how it is impossible for the malarial parasite to exist without having some kind of growing protoplasm in which to carry on its life processes. To perpetuate itself the malarial parasite must choose some kind of suctorial animal or insect which is

capable of injecting it again into the blood of man. From one point of view we may say that the fact that the malarial parasite lives in the *Anopheles* is an accidental process, but on the other hand one may claim that on the part of the malarial parasite, at least, it is the result of a *natural selection*.

From what we know about the nature of yellow fever, viz., that in order to convey this disease *Stegomyia fasciata* must bite the patient within the first three days of the disease; that this mosquito must have a resting stage of some 12 days before it is capable of transmitting the disease back to man; that it is then capable of transmitting the disease for as long a period as 57 days; that if the drawn blood from man be filtered the serum if inoculated into a healthy man will give rise to yellow fever; and that if this filtered serum be heated to a temperature of 120° the infectious microorganism or its spores will be destroyed; and if we will by analogy reason from what has been truly demonstrated in the case of malarial fever we will be convinced that the yellow fever germ, whatever its true shape, form or size may be, must belong to the animal kingdom, as does the malarial parasite, and perhaps also to the natural order Gymnosporidia and class sporozoa; and further, that it must undergo some similar development to that of the malarial parasite.

Koch has proved that the malarial parasite of man cannot be conveyed to the ape (*Hylobatés agilis* and *Hylobates syndactylus*) and from this observation it is believed that the malarial parasite of the ape cannot be conveyed to man. Whether the malarial parasite of birds can be conveyed to man, I believe has not yet been tested.

We do know this much, that the malarial parasite is capable of hibernating in the blood of man throughout the entire winter, and I have reported two suspicious cases of this kind in the *American Journal of the Medical Sciences*, March, 1903. (Later, March 17, 1906: I can

now say that I have found malarial parasites in the blood of man in every month from September to March 17. In one instance the initial attack occurred in October, 1905, with a recurrence in February, 1906.)

In a routine examination of the blood of soldiers returning from the Philippine Islands, Craig (*New York Medical Record*, February 15, 1902) found the malarial parasite in 195 patients, 90 of whom were suffering from other diseases which masked the malarial attack, such as dysentery, rheumatism, indigestion, and the like; while he found 105 patients in whom the malarial parasite was present, and in whom no symptoms whatever existed.

While it might be a matter of pure speculation to presume that the germ of yellow fever might also hibernate in the blood of man or infected mosquito, a simpler explanation is offered from the fact that, as we all know, yellow fever exists in South America throughout the year. From this occurrence cases of the disease may readily come into American ports, or else infected mosquitos might be brought to such ports in trading and other vessels. Thus it is that South and Central America act as a perpetual menace to the inhabitants of the entire earth.

The building of the Panama Canal is not a question of politics; it is a question of public health.

I have briefly reviewed the work done by other workers in this field of scientific investigation, and will now detail some personal observations regarding malarial fever and the mosquito *Anopheles*. These observations may be divided under two heads: History of observations in Pennsylvania, and history of observations in Texas.

HISTORY OF PERSONAL OBSERVATIONS REGARDING MALARIAL FEVER AND THE MALARIAL-CARRYING MOSQUITO (ANOPHELES) IN PENNSYLVANIA.

My first experiments to prove that the mosquitos of America act as the definitive host for the malarial para-

site were made on the afternoon of December 29, 1899, while a resident of Philadelphia. The patient was a lad whose blood showed crescents and ovoid bodies, but after a trial of two hours the mosquitos refused to bite the patient, and my experiment, like many other first trials, proved to be a dismal failure. These mosquitos were specimens of *Culex* and, if my memory serves me right, had been kept in a glass fruit jar for a period of several weeks and fed upon bananas and a little sweetened water. At that time (1899) about all the knowledge I could get concerning the transmission of malarial fever through the mosquito was obtained from short abstracts of the work of Ross, Grassi, Marchiafava, Bignami, and later from Koch.

After the return of Dr. Ronald Ross to Liverpool from India, I put myself in communication with him concerning the subject, and he greatly aided and encouraged me in every way possible; and was good enough to lend me for study one of his first and best specimens, showing the malarial parasite (zygote) after it had undergone development in the mosquito. It will be remembered that Dr. Ross was the first to prove that the *Anopheles* act as the definitive host of the malarial parasite. This discovery was made on August 20, 1897.

At that time I was making a careful study of all mosquitos of Philadelphia, and also those sent to me from Texas, in which connection I wish to acknowledge my indebtedness to Dr. J. H. Sears, since deceased, who was kind enough to mail me specimens from Waco. Among these I had the pleasure of seeing my first specimen of *Anopheles punctipennis*.

The classification of the different mosquitos was made by Mr. C. W. Johnson, Curator of the Wagner Free Institute of Science of Philadelphia, and by Dr. L. O. Howard, Entomologist of the U. S. Department of Agriculture at Washington. At that time the special kind of mosquito instrumental in conveying the malarial parasite from man to man, and the one which was princi-

pally employed by Ross, Grassi, Marchiafava, and Bignami, was what was then called the *Anopheles* "claviger," and I now recall a special trip I made from Philadelphia to Washington to see Dr. Howard, who told me he knew of no species by the name of "claviger," but that the descriptions given of it abroad seemed to prove that it was our own *Anopheles quadrimaculata* (or *maculipennis*), and who showed me specimens of this species. I had also read of the descriptions written by Ross of how to identify the *Anopheles* larvas, and how they could be differentiated from the *Culex* larvas, in that the *Culex* larvas floated with head submerged, breathing through a spiracle at the end of its tail, while the larvas of *Anopheles* would be found to "float upon the surface of the water like 'sticks,'" "and when disturbed would wriggle away with a backward skating movement." So that in Philadelphia I began looking for that particular mosquito larva which lay upon the surface of fresh water like "sticks." I was the first one in Philadelphia to discover them. This occurred about noon on June 19, 1900, at which time I dipped up in a small tin cup several larvas with transverse stripes across the back, having a dark color, and which lay upon the surface of water like "sticks." They were discovered about two miles from the last row of houses skirting the city on the south, and about a mile north of the League Island Navy Yard, and were found in a small, slowly-flowing stream of fresh water coming from a marshy district and alongside a railroad embankment. It was my fourth visit to that neighborhood. This breeding-ground for the *Anopheles* furnished me the malarial-carrying mosquitos for nearly two years, during which time my subsequent investigations were carried on. In my visits to this stream where the *Anopheles* were breeding I saw numerous fish swimming about, and on one visit I dipped up a perch, so that it does not always follow that to stock a stream or lake with fish will abolish mosquitos. On June 19, 1900, I made these notes:

"It has been said that *Anopheles* larvas are not found where fish abound. However, within a few feet of where these *Anopheles* larvas were caught, two small fish—pike, about 3 inches in length—were seen resting near the surface of the water." The reason for this is due to the fact that *Anopheles* larvas lie in the green algæ and upon the top of it, so that they cannot be seen by fish. There were no larvas of *Culex* in the streams where the *Anopheles* larvas were found, though on the other side of the railroad embankment nearly all the larvas belonged to the genus *Culex*. The water was probably two feet in depth, and the *Anopheles* appeared to be mixed in with the greenish moss or algæ, since all were dipped up together.

Should anyone desire to find the breeding-ground of the malarial-carrying mosquito, I would advise him to first look for this greenish moss (or algæ); then for the larvas. Often the larvas cannot be seen until they have pulled themselves loose from the meshes of this greenish algæ.

On placing these larvas in a glass fruit jar, together with a small amount of algæ on which the larvas feed, and covering the top with mosquito netting I was rewarded several days later by finding full-grown specimens of both *Anopheles quadrimaculata* and *Anopheles punctipennis* inside the jar.

Subsequently I discovered four other breeding-grounds for the malarial-carrying mosquito in and near Philadelphia. One near the League Island Navy Yard; one in Oak Lane; one at Seventy-ninth street and Island road, and one in Woodside Park.

On July 29, 1900, the *Anopheles* larvas were more abundant than I ever saw, and I made a note stating that about 50 *Anopheles* larvas had been dipped up on that day. In 1900 I was informed that malarial fever was very infrequent near League Island Navy Yard, but I have read of more recent reports which contradict this information.

As to the length of time an *Anopheles* may live I am unable to say, but I have kept them a few days longer than the Italian observers, my specimens living in captivity 27 days.

The longest period I have ever kept the *Culex* in captivity was from October 28 to December 28, or 60 days.

On September 10, 1900, I found *Anopheles* larvas in a spring branch in the Pocono mountains of Pennsylvania and at an elevation of some 3,000 feet above the sea-level. I learned that several miles toward the north (at Tobyhanna) malarial fever was more or less prevalent. In my investigations in Philadelphia I learned that the *Anopheles* larvas grew abundantly from June 19 until October 16, when, on account of cold weather, they began to disappear, and on November 11 I searched over one breeding-ground without finding any specimen of the *Anopheles* larvas. I had no trouble in catching a number of full-grown *Anopheles* on November 1, 1900, four of which died during captivity eight days later.

My observations in Pennsylvania and Texas demonstrated that the male mosquito became more numerous in cold weather and when frost came on, while the female gradually disappeared. In order to demonstrate more clearly the relation which the malarial-carrying mosquito bears to malarial fever, I will tell how one of the breeding-grounds for the *Anopheles* was found.

For several years in Philadelphia I was associated with several hospitals in the capacity of assistant physician to the out-patient department, and in this way I would occasionally come across cases of malarial fever in patients appearing for treatment. On one occasion a patient, aged about 20, came into my clinic at the Howard Hospital, and obtaining the correct address, which was some 10 miles from the hospital (Seventy-ninth street and Island road), I went to the house, but found no one at home. However, on searching a barn in the immediate neighborhood, I had no trouble in finding many full-grown *Anopheles quadrimaculata*, and some

200 yards from this barn I also discovered a breeding-ground for the *Anopheles*. At 5.30 p.m. on August 7, 1900, I selected several specimens of blood from the end of the finger of the patient, and stained the malarial parasites with methylene-blue and also by Manson's carbol-fuchsin method. But if I should be now called upon to designate more reliable stains I would name the Nocht-Romanowsky (which is the best) or Wright or the carbol-thionin stains. August 16, 1900, on going to the same neighborhood from which this patient came, I obtained the following interesting history of events to the inhabitants living within a radius of perhaps 100 yards:

"Mrs. D. had chills in 1899 and again in the spring of 1900; Mrs. M., a near neighbor, had chills in the early spring of 1900; Mr. W. had chills six weeks ago; Mr. D. had chills two weeks ago; Mr. R. had chills last week." It is also interesting to relate that every one of these patients, as well as the one who came to my clinic at the Howard Hospital, had suffered with chills recurring every two days. It goes without saying that somebody suffering with tertian chills was responsible for and started the epidemic of malarial fever in that locality.

I may add that in Philadelphia I never but once failed to find the malarial-carrying mosquito (invariably the *Anopheles quadrimaculata*) in the houses in which autochthonous cases of malarial fever prevailed. I might also note almost the same experience in Texas, except that in Texas I have *not yet failed* to find them. I might add that a distinguished physician of Philadelphia jocularly informed me that "I would not find the malarial-carrying mosquito in that city."

During the period in which I was engaged in investigating the life history of the *Anopheles* I was also busy endeavoring to determine whether or not I could make the malarial parasite grow and develop in the middle intestine of the *Anopheles* in order to prove the claim

that this insect does in truth and in fact convey from man to man the parasite of malarial fever. For 14 months I had been engaged in trying to prove this claim, and on November 1, 1900, I allowed several full-grown *Anopheles* to bite an individual in the charge of my friend, Dr. Frederick Packard, at the Pennsylvania Hospital, and in whose blood I had found both ovoid and flagellated parasites, and on Monday, November 5, 1900, while at work in Professor Simon Flexner's private laboratory at the University of Pennsylvania I dissected one of them and found four zygotes growing near the lower end of the middle intestine of the *Anopheles*.

Through the invitation of Dr. W. W. Keen, its president, I had the pleasure of presenting the specimen before the College of Physicians of Philadelphia on the evening of December 5, 1900, and again before the Texas State Medical Association, at Austin, in 1904.

This was the second successful result in America, Thayer's being the first, and he only preceded me by a very few months.

HISTORY OF PERSONAL OBSERVATIONS IN TEXAS.

Since my return to my native State I have not given up the search for the malarial-carrying mosquito, nor have I been discouraged in the work to eradicate the disease which it conveys. My first observations to discover the breeding-grounds of the *Anopheles* were made in and around Beaumont, Texas, and later in my home at Tyler. Up to this time I have found in Texas three different species of *Anopheles*, namely, *Anopheles quadrimaculata*, *Anopheles punctipennis*, and *Anopheles crucians*. *Anopheles quadrimaculata* (*claviger* or *maculipennis*) in my experience is by far the most prevalent species in Texas and in Pennsylvania.

June, July, and August, 1901, I spent in and around Beaumont, Texas, and during these months in the city of Beaumont I searched diligently for the *Anopheles* in the dwellings and hotels, and while there were hundreds

of *Culex*, I never found one specimen of *Anopheles*. I do not at this time wish to condemn either Waco or Tyler for harboring the malarial-carrying mosquito and at the same time to give Beaumont a clear bill of health, since I have no doubt I could have found the *Anopheles* in the residences in the more remote parts of that city if I had taken the time.

Some 13 miles southwest of Beaumont at the little town of Fannett on the Gulf and Interstate Railroad, and in the open prairie, I found several breeding-grounds for the *Anopheles* as well as the full-grown specimens in certain houses. Malarial fever is more or less prevalent around that locality. The specimens obtained were *Anopheles quadrimaculata* and *Anopheles crucians*. While the *Anopheles* prefers to deposit its eggs upon slowly flowing streams of fresh water, I may say that near Beaumont on one occasion I found the larvas growing in a barrel containing a small amount of rain water and some dead leaves and located within a few feet of an inhabited dwelling.

While on a fishing trip about two miles east of Beaumont (and in a dense forest) I had no trouble in finding many *Anopheles* in the top of the tent each morning. Some employes of a railroad construction party living in the immediate vicinity were suffering at that time with chills and dysentery.

In Tyler, Texas, I have discovered the *Anopheles* larvas in midwinter (December 21, 1902). At that time the temperature was almost at the freezing-point, and a rather severe freeze with ice had occurred several weeks previously.

On Monday, January 19, 1903, I found a very large full-grown female *Culex pungens*. This mosquito had been disturbed and flew from behind some old books stored in my office.

A very recent experience which occurred in a fishing party of which I was a member during August of 1905 may be of interest. Several of us had camped in a region adja-

cent to Saline Prairie, in Smith county, Texas, and also about a mile from the Neches river. We pitched our camp (covered by the dome of heaven) in the yard of an inhabited house, consisting of a family of several members. The rain ran several members of the fishing party into the house and several slept without a mosquito bar. Certain occupants of the house had a few days previously suffered with chills. Our party was driven by rain into this infected house on the night of August 7. On August 20, in spite of the fact that each one of our party as a prophylactic measure had taken two or three 4-grain capsules of quinin, one member who had taken 12 grains a week or 10 days previously began to suffer from malaise, and later by fever, which on August 22 mounted to 102.4°. On the afternoon of this date I selected several specimens of blood from the tip of the finger, and after staining them by the Wright method, and also by the carbol-thionin method, I had no trouble in finding ring forms and other merozoites of the estivoautumnal parasites present. On obtaining a history of the family living in the house where the members of the party had spent the night of August 7 I learned that every member of the family had suffered with malarial fever except the father, who had for several years been in the habit of sleeping under a mosquito bar.

The evidence is therefore more or less clear that the member of our party who developed malarial fever was infected on the night of August 7 and the period of incubation was about two weeks.

After spending two nights near the infected house we moved our camp over on the banks of the Neches river. The mosquitos here fairly swarmed about us during the daytime and were equally as bad at night. During the day I made careful observations, but never detected a single specimen of *Anopheles*, all being *Culex*. I do not wish to be understood as saying that *Anopheles* do not bite during the day, for at the infected house mentioned they bit severely about 2 p.m. on August 8, im-

mediately before a rainstorm. At our camp on the Neches river I left my dark-colored umbrella open during the night, and on awaking in the morning found some 50 *Anopheles quadrimaculata* clinging within it. This was again repeated on the following night, with the result that about the same number of *Anopheles quadrimaculata* were found in the umbrella at daylight. These mosquitos had been attracted to our camp during the night hours. Mosquitos are attracted by colors which are dark or black, and therefore the interior of houses located in districts where malarial fever prevails should be painted white in color.

PREVALENCE OF MALARIAL FEVER IN TEXAS.

The people of certain districts in Texas are occasionally thrown into almost a panic when the existence of yellow fever is made known to them, and with unseemly haste prepare to fly from this plague visited upon them. It might be well for the people of this State if that day would come when the existence of chills and fevers in any district would cause an equal degree of anxiety. The feeling of security against malarial fever in Texas is entirely too complacent. Its ravages must be suppressed by the work of an efficient State Board of Health.

In a paper which I presented before the Texas State Medical Association at Austin in 1904, and printed in the Transactions for that year, I called attention to the fact that one soldier in every seven stationed at the different army camps established in Texas by the United States government fell ill of malarial fever; of the total number of employes of three different railways traversing Texas, one employe in every four fell ill of malarial fever; and taking the city of San Antonio as an index as to what was occurring all over Texas, I learned if the statistics were absolutely correct that one person in every six in Texas suffered from malarial fever. I

know there are many mistakes made in the diagnosis of malarial fever, and that such statistics are too high. If we should say that mistakes in diagnosis were made in 50% of the cases, we would still find that one person in every twelve in Texas suffers with malarial fever, entailing a loss to the people amounting to upwards of $5,000,000 a year, while over 3,000 people each year die of this disease.

With the energy and resources of this great State behind it, and with the genius to baffle the tidal waves of the raging sea and to shut them out forever, the people of Texas must not hinder the hand of progress, but must keep it raised by creating within its confines a State Board of Health with power to wield the effective measures necessary to stay the hand of death and to destroy forever the enemy of all its people—malarial fever.