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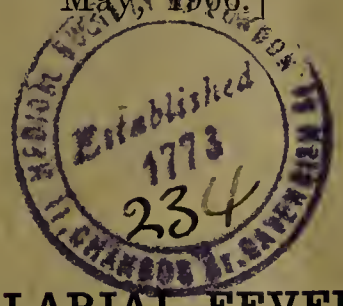

MALARIAL FEVER.*

BY

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Mr. President, Ladies and Gentlemen: Through a most cordial invitation tendered me, I have the honor to speak to you this evening on a subject which has engaged my undivided attention for upwards of eleven years. Long before I began the study of medicine I became interested in this subject, and after my graduation there seemed to be some kind of fascination about the work which has kept me searching here and there, in the nooks and dark corners, for any new facts, any new truths which might be hidden in them.

Well do I remember an address given us students at the University of Pennsylvania by that distinguished physician and author, Dr. S. Weir Mitchell, in which he advised all young practitioners of physic to take up some kind of hobby which would be profitable and would enrich their gray hair with pride. He advised us students to take up some line of investigation or research work in one of the sciences, such as botany, geology, or any other kind of original work, and to "ride that hobby hard." He went further than this, and tried to stir up within us some feeling of restlessness, some of the deeper sentiment which would formulate an ideal. He wished us to read Ruskin, whose works had given him more real pleasure than all other works he had read. It is Ruskin who pours out to us the story of Athena, the Neith of the Egyptians, the Athena of the Greeks, the Minerva of the Latins, and who instils into us the four cardinal virtues governed by Athena, prudence, justice, fortitude and temperance. It is Athena who wears two robes, the one of light, and the one of darkness. It is always Athena that we hear in the sound of trickling water, that we see in the golden embroidered robe of the purple cloud; that produces the rust-

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ling of the leaves of the trees, for indeed it is Athena who is "queen of the air." Dr. Mitchell desired us to get out into the world and seek for new ideas, believing with Wordsworth that;

> "Nature never did betray
> The heart that loved her; 'tis her privilege
> Through all the years of this our life, to lead
> From joy to joy; for she can so inform
> The mind that it is within us, so impress
> With quietness and beauty, and so feed
> With lofty thoughts, that neither evil tongues,
> Rash judgment, nor the sneers of selfish men,
> Shall e'er prevail against us, or disturb
> Our cheerful faith that all which we behold
> Is full of blessings."

So that if I have any hobby at all it must be the study of malarial fever.

I am proud at this time to say that though there may be some commercial rivalry between the cities of Texarkana and of Tyler, medical science has risen above this motive in life. Indeed science is universal and the work of an investigator in the remotest part of the earth cannot be lost, and new discoveries in this day and time fly out swifter by far than the wings of night, and within a day a discovery made in Europe goes straight to India, or Japan, or America.

Medicine cannot be bound down by narrow and constricted laws made by men, and if hedged in will burst the bands asunder and forever grow. Medicine is non-sectarian, knows no creeds nor dogmas; knows no "schools" nor "systems" of medicine. The word "school" of medicine is set down in the law books, and has become firmly fixed in the minds of judges upon the bench, and no doubt enjoys the privilege of keeping company with many "wise saws" with which we have been told his head is filled.

There is in truth and in fact no such thing as a "school" of medicine.

So that it has come about in this the twentieth century that a professor of medicine or surgery, or therapeutics, in any country in the world, can go abroad and feel at home in any of them. I only have to remind you that our own Osler has within the past year been called to Oxford University.

We find the same types of malarial parasites in Texas that are found in Italy, in Africa, and in India.

If you have a case of malarial fever in Texas, and spread a drop of that patient's blood upon a minute piece of glass and send it to Berlin, or Paris, or Rome, the doctor there can inform you the type of that malarial parasite, and can come pretty near telling you when your patient will have his next chill.

The speaker is at this moment endeavoring to obtain specimens of malarial parasites from Panama.

The Origin of Malarial Fever—As to the origin of malarial fever, it is best to at once dismiss from your minds once and for all time the ancient idea that malarial fever or "malaria" may be taken into the system of man through the medium of air or water. The old idea that malarial fever originated in stagnant water, or swamps, and that the night air was filled with "dank humours" or malarial poisons blown from them, was an idea fit for the almanacs, but not for the medical books of the twentieth century.

It might be safely said that if one be protected from the bite of an infected mosquito, that one might sleep for a thousand years immediately over the worst swamp in Arkansas or Texas, and though he might drink all the stagnant water in these marshes, he will never contract malarial fever by such mode of living. I do not mean to say that the man who so lives might not suffer at times from general body pains, and perhaps fever, but I mean to say that in my opinion he will never suffer from malarial fever. In other words, there is no such thing in the world as "malarial poison," and when a person speaks of being "full of malaria" the term has no meaning whatever, unless that person refers to the effects produced by a living micro-organism living in his blood. It is the germ that causes the malarial fever; it is the germ which may be easily seen with a good microscope, and it is the germ that is killed by quinine. When this germ is destroyed by quinine the patient is no longer "full of malaria."

I inform you that this small germ (which can only be seen by aid of the microscope) and other forms of fevers in India destroys the lives of upwards of 5,000,000 of her people every year. But we need not go so far away to get statistics about this disease. What would you say if I told you that according to the statistics of the seven United States Army Posts in Texas, and the statistics of three of the largest railway hospitals of Texas, go to show that at least one person in twelve

in this State each year suffers from malarial fever, and that the expense to the people of Texas on account of malarial fever amounts to the enormous sum of $5,000,000 to $10,000,000 a year? What would you think if I told you that basing the statistics on that obtained from the city of San Antonio, that in Texas every year over 3,000 people die from the effects of this disease?

It is no wonder that the most influential newspaper in this State (Texas(took me to task in its issue of June 21, 1904, after I made that statement. It was not my statement, because it was the records which spoke, and I did not make those records. I find that this same paper in so far as the commercial aspect of the question is concerned, has become converted and so expresses itself in an editorial under date of March 5th, 1906. If we want to protect the commercial interests of Texas we must first protect the health and the lives of all the people living in it. And I must say that at the present time no organized movement is on foot to protect the people against malarial fever.

On an average yellow fever kills about fifteen people a year, and upwards of $42,000 is spent to prevent it; while malarial fever kills about 3,000 people a year, and nothing is done to prevent it.

Really this condition would almost be funny if it wasn't so serious.

Texas ought and must have a State Board of Health in order to get rid of malarial fever.

From a commercial point of view we might say that some of the best land in Texas, especially along the river bottoms and districts subject to overflow, cannot be cultivated on account of the danger from malarial fever. But again remember, it is not because of the fact that water is present that produces the chills and fevers. It is because that this water is the breeding-ground for millions of malarial-carrying mosquitoes. If you could keep all persons (negroes and ignorant people) suffering with malarial fever out of these swamps, there would be no malarial fever in those districts.

Now this condition of things should not exist in Arkansas and Texas, for the reason that it will be a plain business proposition to get rid of the disease when the people become thoroughly enlightened on this question. There is no reason why the people of Arkansas or of Texas should be more fre-

quently affected by this disease than the citizens of New York or Pennsylvania or Maine. One reason that we have not already become alarmed over our condition is that we have grown accustomed to having chills and fevers. When a physician is called to the country, especially to the home of one of our colored brethren, it is no uncommon thing to be told that the baby only "has de chills."

As to the exact date of the first case of malarial fever that ever occurred in the world, history will never explain any more than we will ever be able to determine the exact date of the first case of smallpox, the first case of yellow fever, or of measles. We do not know where the first malarial parasite came from. All that scientists are able to say is that one germ came from some pre-existing germ, and that like begets like. Therefore we can sum up in a few words all that is known on this subject by saying that the first malarial parasite came from some pre-existing malarial parasite.

Think of the millions of human lives, and the billions of dollars this small microorganism has destroyed in the thousands of years of the world's history, and then recall that science only discovered this parasite just twenty-six years ago!

It is a glorious thought for us in this the twentieth century to be engaged in putting such an arch-enemy of mankind under our feet and to stay the hand of death from those we love.

The Nature and Development of the Malarial Parasite—Let us now get more closely acquainted with this germ of chills and fever, and to do this we must call to our assistance all of the skill of the zoologist, the biologist, the entomologist, and the bacteriologist.

If we go to the zoologist for information he will begin by saying that this little circular form or ring-shaped parasite found in the red blood corpuscles of man belongs to the natural order gymnosporidia, class sporozoa; that it is divided into different genera such as (a) Hemameba, and (b) Laverania; into different species—hemameba malariae (quartan), hemameba vivax (tertian), and hemomenas precox (remittent fever-Ross), and also into different sexes.

According to Marchiafava and Bignami of Italy, the mature sexual forms (gameti forms) of malarial parasites are termed gametes, the female sexual form being called macroga-

metes, and the cell which produces the male element is termed the macrogametocyte.

If we draw a drop of blood from the ear or end of the finger of a patient suffering with malarial fever, and allow it to remain on a warm stage and in a moist air-tight compartment, for about fifteen minutes, it will be found that at the end of this time a few of the fully developed forms of parasites will have developed one to five flagellae or little arms which wave about in different directions, and being sufficiently strong to pull the parent microorganism around in different positions of the microscopic field. In the course of time some of these little arms or flagellae tear themselves loose and penetrate other fully developed forms of parasites, and by this means fertilizes them. These free flagellae which tear themselves loose are called microgametes.

When the blood has been withdrawn from the circulation by a special kind of mosquito (since all mosquitoes cannot convey malarial germs) known as the Anopheles, which has spotted wings, this insect swallows red blood corpuscles parasites and all into it stomach, where the same changes occur as stated above. After a few hours the fertilized flagellated parasite, which is called the "vermicule," pushes its way outward through the epithelial cells or lining membrane of the insect's stomach or middle intestine, and later buries itself in the muscular layer and outer surface of this organ. After this phenomenon has occurred, the word "parasite" is no longer applied to this germ, but it is now called by the biologist the zygote oocyst, or sporozoon, all of which mean the same thing.

After seven to ten days have elapsed it is found that these zygotes will have developed within their interior hundreds of small spindle-shaped thread-like bodies or sporozoites, or spores, of the malarial parasite, and still later it will be found that the parent zygote becomes so filled with these little spindle-shaped spores that it ruptures much in the same way that the mother tick does when it sets free the seed-ticks, and these spores are washed by the insect's blood upward into its salivary glands, to be poured out into the blood of man the moment the insect bites, and in this way inoculates him with the seed or the spores of malarial fever, which will within the course of 2 to 14 days develop into the shape of round bodies and so give the man a chill.

It should be remembered that the mosquito has no closed system of blood vessels as occurs in man, but the blood (which is white in color) is washed freely amongst all the tissues, being pumped by means of the dorsal vein, which is nothing more than a mere tube open at each end. Thus it will be observed that while the mosquito sucks into its body the full grown or young form parasite which is round in contour, it injects or inoculates into the blood of man a minute spindle-shaped body from which again develops the full grown parasite. After these spindle-shaped spores are injected into the circulation of man they at first attach themselves to the outer surface of the red corpuscles, and I have many stained specimens showing them adhering firmly to the outer rim of the corpuscles. Later these spores gain entrance into the interior of the red cells, when they assume a ring shape. After from 2 to 3 days these intra-corpuscular parasites will have grown to the size of a red blood cell, when they undergo sporulation, and break up into from 8 to 20 small round segments or spores. This process of sporulation occurring in the blood of man is coincident with a chill, and hence observers by watching in the blood these malarial parasites, have predicted when a chill would occur.

Thus it is that the malarial parasite has chosen two hosts to perpetuate its existence: one the body of man which acts as the intermediate host, the other the body of the Anopheles which acts as the definitive host, and one host is just as important as the other in the complete life history of this microorganism.

Thus it will be seen that malarial fever, or "chills and fever," is a very "catching" disease. This fact will be gradually learned by the editor at his desk; the banker in his counting room; the merchant in his store, and the farmer upon his plantation. I should say that it will require many years to complete the circuit.

The one who first discovered the fact that the mosquito might act as the definitive host for the malarial parasite and be the carrier of the malarial fever germ, was Dr. Ronald Ross, now of the Liverpool School of Tropical Medicine, but formerly surgeon in the British Army. Dr. Patrick Manson of London was the first one to formulate a complete theory regarding the disease, and Ross, after several years' hard work, proved that the theory was true, by working out

~~of a microscope. You will observe in this specimen that the~~ the life history of the parasite in the mosquitoes he dissected. In India Ross worked over his microscope two years without finding anything to give him encouragement, but finally on August 20, 1897, he succeeded in discovering the zygote of malarial fever developing in the mosquito, and the honor of the discovery belongs to him.

After Ross came the Italian observers, Grassi, Marchiafava and Bignami, and after them came Koch of Germany. Later and in the summer of 1900, Dr. W. S. Thayer of Baltimore succeeded in obtaining three positive results which, unfortunately, were destroyed (two of them by a laboratory servant), and a few months later, on November 5, 1900, five years ago, I had the honor of being the second in America of proving that the Anopheles do act as the carrier of the malarial parasite. It is my pleasure this evening to exhibit before you this specimen of zygote lying within the muscular walls of the mosquito's stomach or intestine, which I dissected by ~~means~~ aid of a microscope. It will be observed that the zygote has carried with it from the blood of the patient suffering with malarial fever whom it had bitten, the hemoglobin derived from the red blood corpuscle. This mosquito had bitten, four days previously, a patient suffering with estivo-autumnal fever, so that the zygote is 4 days old.

My friend, Dr. L. Napoleon Boston of Philadelphia, has been kind enough to use my pen-and-ink sketches to illustrate his book on "Clinical Diagnosis," just out of press, which you will observe shows the specimen more completely.

Eight years of work and upwards of half a million dollars have been consumed by the best workers of Europe to prove all these different steps I have enumerated above, but it is worth the cost a thousand times over.

The work of Dr. Ronald Ross in the beginning was not a mere caprice or holiday pleasure. Science with an all-consuming flame for new things, sapped from him both health and money. Thus in one of his letters to me, dated October 1st, 1900, he spoke of having gone to Wales, and in his words, "The constant work on one subject has **almost driven me wild,** as you imagine." In a later letter to me Ross says: "**Unfortunately I am already ruined (financially) by scientific work.**"

This discovery of Ross threw a new glamour about the study of yellow fever, and it was only two or three years later when our own countrymen, Reed, Carroll and Lazear (the

latter of whom died that others might live) with Agramonte of Cuba, proved that the mosquito, Stegomyia fasciata, acts as the sole carrier of yellow fever. Do you not believe that if Ross had not made the discovery that mosquitoes act as the disseminator of malarial fever, that we would still each year be confronted with the danger from yellow fever, through useless fumigation and shotgun quarantine?

Let us reflect for a moment in this race of life and try to discern whether or not this discovery of Ross may not have had some influence on the commercial interests of the American nation. Let us recall the fact that the French nation many years ago endeavored to link the oceans together with their Panama canal. What happened? The answer is, as doctors know full well, that too little interest was paid to the question of the public health, and thousands of their people died, and the enterprise, costing ~~$40,000,000~~ $260,000,000, was a miserable failure. The building and maintenance of the Panama canal is not a question of politics, nor of a sea level, nor of a lock canal: it is a question of public health. If it had not been for Dr. C. A. L. Reed and a few others, the American Government would have perhaps made the same fatal blunder as did the French Government. (See Journal American Medical Association, March 11, 1905). But now a strip 50 miles in width and running through Panama—thanks to the ever-vigilant Dr. Gorgas—is as healthy, he states, as the country between Philadelphia and New York City.

Think of it! We are told (Gorgas—Journal American Medical Association, February 3, 1906) that under French occupancy 20 years ago, that many employes of the canal were found dead along the roadside, and it is uncertain just how many died along the line. At Ancon every Frenchman contracted yellow fever, and more than half of them died. Three members of the medical staff died in one day, and nine within one month. Of thirty-six sisters brought over as nurses, twenty-four died of yellow fever. Of eighteen young French engineers who came over in one vessel, within a month all had died but one.

At the end of many fleeting years which shall have gone; in the distant future when there will be no such thing as yellow fever and malarial fever, and when these two diseases will no longer menace the health and the lives of the inhabitants of India, of the United States and of other nations; at

that time when the farmer at his plowshare can till the soil with no fear of impending danger; and when men upon the mightiest battleship and lightest ocean craft shall smile at Nature's undoing as they sail under the brow of old Culebra, and whose freighted vessels shall churn the watery link at Panama, I feel sure that no name will be held in greater veneration and esteem than that of Ronald Ross, the discoverer of the life history of the germ which has slain its millions, and rendered such an undertaking as this canal an absolute reality. Surely it was a beautiful tribute to genius and perseverance, when the appropriate committee recently awarded to him the Noebel prize of $40,000 for "eminent service to mankind."

And yet he is not through with his labors. Only within the past two weeks a letter has come to me from him informing me of the good work now being done in regard to malarial fever in Ismailia and the Federated Malay States.

The Diagnosis of Malarial Fever—If by means of a rather large size needle we prick the lobe of the ear, or end of the finger of a patient who has chills and fever, and spread this blood on a piece of glass, and stain it with either the Nocht-Romanowsky, or Wright, or other stains composed of some form of aniline dye, and examine this stained blood with a microscope which magnifies the red blood corpuscles from 800 to 1300 times, one may observe the malarial fever germs which have been stained in two different colors, and lying within the red blood corpuscles. This is the quickest, the surest, and the best way for the physician to obtain sufficient evidence by which he is able to say to his patient, that he either has, or he has not malarial fever. Ofter the physician must show this stained malarial parasite to his patient before he fully understands that such a simple thing as chills and fever is due to a germ, and that this germ lives in his blood.

I will leave it to the conscience of the individual doctor who cannot stain this micro-organism, and who is unfamiliar with the microscope, whether he is doing his full duty towards his patient in doubtful cases of malarial fever.

In continuing I may say that after the blood has been spread out on a piece of clear glass as stated above, and after having been stained, it will be found that the small merozoite, or the very youngest form of malarial parasite, or that young body which has been injected in the spore

form by the malarial-carrying mosquito, may be seen adhering, or somewhat overlying the rim of the red corpuscle as though it was clinging onto the corpuscle for dear life, and that the body or protoplasm of this small parasite is stained a deep blue color, while at the other end of it we may see a small red or garnet colored dot, which is the chromatin or the staining portion of the nucleus of the parasite. It thus appears that the spindle-shape spore injected by the mosquito changes its shape as it passes through the system of man.

Through a letter received during the last two weeks, I learn that the Leishman method of staining the malarial parasite is a very popular one in England, but whatever method is used, we should be able to see both protoplasm and nuclear figures.

I have many of these young morozoites clinging to the red blood corpuscles which I shall be pleased to show to anyone sufficiently interested.

After this small merozoite has remained attached to the rim of the red cell for sometime, it finally gains entrance to the corpuscle which it continues to devour, constantly breaking down the hemoglobin, and assumes a "ring" shape. Now this "ring" shape form is a most important stage to remember, because we will run across them perhaps more frequently in the pernicious type of fever—estivo-autumnal fever—than any other form of the parasite. Often this ring-shape form of parasite has a slight swelling around one of its parts, at which place the ring is broader, and thus gives what Ewing calls a "signet-ring" appearance. If this ring-form of parasite contains two red chromatin dotlets in opposite poles of the ring, and if such forms predominate over any others, or if we find crescent-shaped parasites, we may be sure that the patient has a case of estivo-autumnal fever, or a pernicious type of fever. Though I would have you to believe that the tertian malarial fever might perhaps be as "pernicious" as any other form. I have found tertian rings containing two dotlets of chromatin granules, but they are not common.

Often these ring-shaped malarial parasites may be found attached to the rim of the corpuscle and be of wide diameter. Frequently we have to look for them as long as half an hour before finding one, but I have the pleasure this evening of showing you a specimen of blood taken from a case of black

jaundice, in which you may see as many as 50 to 100 of these rings, and sometimes as many as four of them in one corpuscle the most parasites which I have ever seen in any specimen. It is stained by my modification of the Nocht-Romanowsky stain, and shows the blue protoplasm, and the red chromatin dotlet of the parasite which may be easily differentiated.

But I must inform you that after the onset of hemoglobinuria occurs malarial parasites are seldom found. In 16 cases of black jaundice which I have studied during the past year, malarial parasites were only found in two of them. After many hours this small merozoite will have grown to a larger size, at which stage some writers speak of it as the microgametocyte, while if it lives a little longer it is called the macrogametocyte.

In the case of the very youngest form of parasite we cannot differentiate between the tertian and the quartan form of fever by an examination of the blood. Frequently, however, we can tell at a mere glance the kind of malarial fever with which we are dealing.

As stated above, often we can within a few moments tell the kind of fever by the characteristics of the ring-forms of parasites. The tertian and quartan types are best distinguished in their later stages or after the microorganisms have become microgametocytes, and macrogametocytes. In these stages the tertian parasite causes the red blood corpuscle in which it is contained to become swollen or of wide diameter, while the parasite exhibits a tendency to spread out in various directions all over the corpuscle, while the pigment granules are quite black and in very fine granules.

Regarding the quartan parasite Ewing says that the ring partakes of the "general character of the tertian ring, but smaller, more compact, and more richly and coarsely pigmented." * * * And "on account of the tendency of the quartan parasite to complete its life cycle in the general circulation, quartan pre-segmenting bodies are relatively much more numerous in the stained specimens than are the similar forms of the tertian organism." And further: "In some specimens taken several hours before the chill the majority of the organisms (quartan) found may present the markedly reticulated structure indicative of approaching division. These coarsely reticulated, relatively small, and richly pigmented (large granules) bodies, lying in markedly shrunken cells,

are very characteristic and not readily confused with any other form of malarial parasite commonly found in the peripheral blood.'' Sometimes the estivo-autumnal parasite may be seen within the shrunken red cell, but in the case of this type the pigment granules are of very much smaller size than in the quartan form. Ewing says that the quartan rosette forms are more frequently found in the peripheral blood than any other type, and may be readily recognized by the small number (six to twelve) and comparatively large size and geometrical arrangement of the spores.

Whenever we see these rosette bodies forming in the blood we can inform our patient that he will soon have a chill or a paroxysm of fever, since after this rosette body breaks up into numerous segments in any of the forms of malarial fever, the parasite elaborates a certain amount of poison or toxin which is poured out into the blood, and on reaching the central nervous system produces a chill.

This method of making a quick diagnosis of malarial fever, and so clearing up points of contention in many continued types of fever is of supreme importance when it comes to making a differential diagnosis beteween malarial fever and yellow fever. True it is that a person may have both malarial fever and yellow fever at the same time, but to say the least such a condition would be very uncommon.

As to the co-existence of malarial fever and typhoid fever, I believe Thayer and Heweston in Baltimore found only one such instance in 616 cases of malarial fever, so that the term ''typho-malarial fever'' should have passed out of the text books 20 years ago, and is no longer used by the up-to-date physician. I will admit that during the recent war with Spain a few soldiers suffering with typhoid fever were returned home, and within a week or two after their recovery malarial parasites were found in the blood. But it is the concensus of opinion that when the two diseases are coexistent that the typhoid runs its course before the evidence of malarial fever is manifested.

The Quinine or So-called ''Therapeutic Test—That day has passed away when one can make the claim that malarial fever is or is not present when based on the administration of quinin. This has been called the ''therapeutic'' test for malarial fever, and was a subject worn threadbare by con-

tending physicians before the microscope came into general use. To expose the fallacy of the reasoning involved in such a question the plainest proposition possible should be formulated which would run about as follows: "After excluding other diseases, and if to a case of fever quinin be given and the fever disappears, the results prove that the patient had malarial fever." I have thought over the matter a good deal, and this is about the simplest proposition I can get out of it. It would be just as logical to say that if to another case of fever quinin be given, and the patient dies, that therefore, the quinin killed him. Either proposition would be full to overflowing with fallacies and would not stand in any court in this or any other country. How much more convincing it would be to say that this or that patient has malarial fever, and "that here is the stained malarial parasite for you to look at, gentlemen."

Moreover, I have many specimens of malarial parasites from the blood of patients who have taken over 100 grains of quinin, and I shall show you some colored plates which represent malarial parasites which still lived in the blood for several months, though upwards of 200 grains of quinin had been taken.

The Diagnosis of Malarial Fever Based on the Occurrence of Chills—The question may often be asked: "Doctor, why do you have to go to so much trouble as to stick your patient's finger or ear and get a drop of blood, and stain this blood, and examine it with a microscope magnifying a thousand times? Can't any ordinary doctor tell when a person has a chill?" To the latter question I would be apt to say "yes," but also remember, my dear sir, that only 60 per cent of the cases of malarial fever we ordinarily meet with (tertian) have any distinct "shake," while the other 40 per cent of the cases would probably not be diagnosed without the microscope.

Thayer and Hewestón tell us that out of 189 cases of estivo-autumnal fever treated in Baltimore, only 52 per cent of them had "chills," while one sixth of that number complained only of "headache, pains in the back, limbs, etc., the symptoms ordinarily accompanying an acute infection."

I cannot understand just where the benefit to the patient would come in if we depend upon the "therapeutic" test, or

wait for rigors or "shakes" to determine our diagnosis of malarial fever.

Prevalence of the Different Types of Malarial Fever in Texas and Elsewhere—From statistics which I have carefully gathered from the seven different United States Army posts along the western border of Texas, and from one of the largest railway hospitals in this State, the prevalence of the different types of malarial fever is as follows: "Thus in the United States Hospital Posts "quotidian" fever occurred in 62 per cent; tertian 11 per cent, and remittent 22 per cent. At the St. Louis Southwestern railway hospital formerly located at Tyler, Texas, the tertian was about 66 2-3 per cent, quotidian, 16 2-3 per cent, and quartan about 1 per cent. In several years' practice in Philadelphia I never met with a single case of quartan fever, and have so far observed but one case in Texas. Thayer and Hewestón in their splendid book entitled, "Malarial Fevers of Baltimore," give the following percentages for Baltimore: Out of 531 cases of malarial fever there were of tertian 62 per cent, estivo-autumnal 35 per cent, and quartan 4-10 per cent.

Where Does the Malarial Parasite Go During the Winter Months, and Why Do Chills and Fevers Become More Prevalent from Spring to Fall?—Considering all the facts which have been enumerated above, one's mind will in spite of himself go back to this thought: "Observing no cases (or at most, few cases) of malarial fever during midwinter, when there are, presumably, no mosquitoes, how can the malarial parasite grow and develop, and flourish during the frost, and ice, and snow? To get at the tap-root of this proposition, we must reflect that the malarial parasite of man is a highly complex form of parasite, and being so, feeds on something which it does not produce. In other words, it requires a highly albuminous food on which to exist. Moreover, it requires warmth, and moisture, and darkness, all of which it finds in the blood of man. Finding that the malarial parasite will grow and develop, and form spores in endless time in the blood of man, it will be discovered that if we killed every mosquito in the world, that we would, for a time at least, still have cases of malarial fever. But you will observe from what has been previously said that this malarial fever would never afflict anyone else than those who already have it, because there would be no medium of conveyance—all mosquitoes be-

ing dead. I might add that I have kept mosquitoes alive in glass jars for as long a period as two months.

If we go carefully into the history of these cases of malarial fever which occur in the early spring (and for some reason which I cannot explain, generally in February and March) when there are, presumably, no mosquitoes, we will learn that practically every one of such cases either had shaking chills, or else some form of fever during the previous fall. And if we are very careful in obtaining this history, we can sometimes tell from whom the patient caught the disease. After the malarial-carrying mosquito comes out of its hiding places in May and June, it is an easy matter to understand how chills and fever are spread from person to person.

The malarial parasite does not make a distant excursion and forage for its food, but may stay in the blood of man all winter (and perhaps in the infected mosquito), and not give trouble until the following spring, when to perpetuate its very existence seemingly, it goes on sporulating, constantly increasing in number until the man comes down with a shiver or distinct chill followed by high fever. In one instance at least (American Journal Medical Sciences, March, 1903) I think I have been able to prove that a patient had brought her malarial parasites with her all the way from Tennessee to Texas, a distance of over a thousand miles.

(Later—I can now add that I have found malarial parasites in the blood of man in every month from September to ~~April).~~ June.

A Case of Malarial Fever, in Which the Parasite Lived in the Blood Throughout the Winter Months—Mrs. B., aged 36, white, large and plethoric, the mother of two children, on October 24, 1905, developed "dumb" chills at 10 a.m. On October 26 she had another "dumb" chill at 2 p.m. The tertian paroxysm now changed into the quotidian type, and she had a shaking chill on October 27 at 3 p.m., and also a shaking chill on October 28 at 11 a.m. A drop of blood was obtained on this day (October 28) at 4 p.m. and stained by means of my modification of the Nocht-Romanowsky method, and two distinct groups of tertian parasites were found, hence the case was one of double tertian infection with daily paroxysms. I have this specimen in my possession. In looking around over the walls of this house I had no trouble in catching upwards of half a dozen Anopheles quadrimacu-

lata, or malarial-carrying mosquitoes. In fact the malarial-carrying mosquitoes in this house were more abundant than the common house mosquito (Culex). Mosquitoes sleep during the day time and may be easily caught by placing a bottle with a large mouth over them. The Anopheles can be easily identified by the fact that all species of this genus have spotted wings, and when they rest on the wall their body projects almost at a right angle from the surface on which they adhere.

As soon as these malarial parasites were found in the blood I put the patient upon quinin, given in the way suggested by Professor Robert Koch, which consists in combatting the parasite in its different cycles of development, which seems to occur every seventh, fourteenth or twenty-first day. Koch tries to kill the young merozoites and other forms by giving quinin for four days, then leaves it off three days, then four more days of quinin, then three days without quinin, and finally four more days of quinin. This is the only case of malarial fever I have treated by this plan which does not seem to have been cured.

I feel sure that my friend, Dr. C. A. Smith, will be apt to have me indicted for heresy, and for going abroad for a method of treating malarial fever, because he is in the habit of giving quinin in hydrochloric acid solution, which is a splendid method, and one which I also use in obstinate cases.

After the administration of quinin the patient got up out of bed and seemed as well as usual for two months, but in January she began to manifest peculiar nervous symptoms, such as twitching about the mouth, general tremors, a feeling as though the blood was rushing to the head, and a fear of impending death. At this time she had no fever.

Two weeks ago, or February 26, 1906, she had a "dumb" chill at 3 p.m., the fever going to 101½, and accompanied with general body pains. On March 28, or two days later, at 2 p.m., she had a slight shaking chill, followed by fever which at 5 p.m. rose to 102 3-5. At this time she complained of general body pains, notably in left side of chest over heart, and in the dorsal and abdominal regions. As the weather for some days previously had been variable and as colds were very prevalent, my first thought was that she was suffering from grippe. However, a drop of blood was obtained about 5 p.m. on February 28, 1906, or ten days ago, and after being stained by means of my modification of the Nocht-Romanowsky method,

much to my surprise I found my old enemy, the tertian parasite, in two distinct groups (double tertian infection)still lurking in this patient's blood, where they had been all winter. I have taken the trouble to paint some of these parasites in colors, which you will observe on the card specimen passed around.

I also have with me the stained specimen which I shall be glad to show to anyone interested.

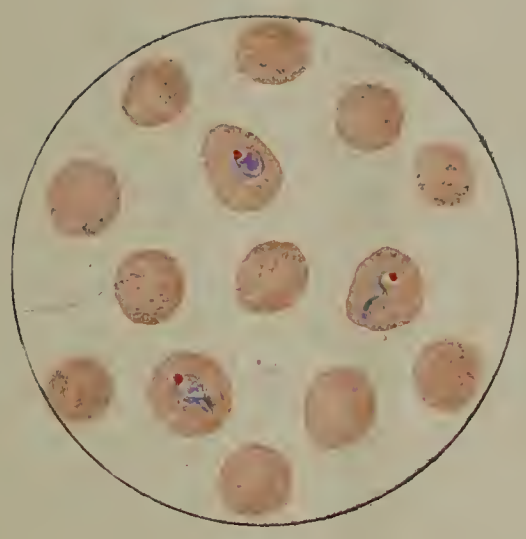
An interesting point in this case is the fact that this patient, during her attack of malarial fever in October of last year, had taken tonics and upwards of 200 grains of quinin, but these parasites which I show you were not destroyed.

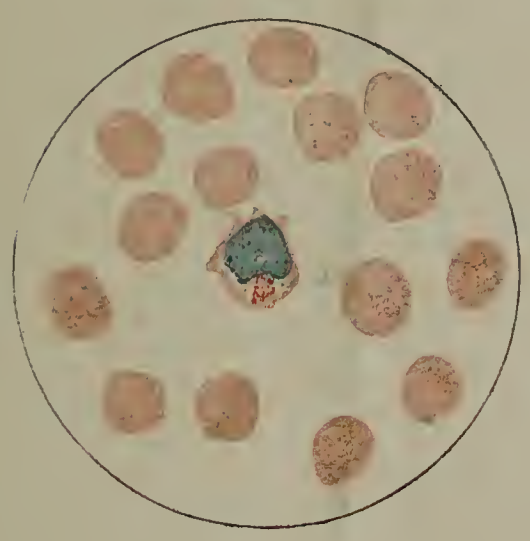
So far as I am aware this is the first observation of this kind which has been made in Texas proving that the malarial parasites may survive the winter in the blood of man.

I also found the malarial parasites present in this patient's blood on March 1, 1906, or nine days ago.

In these colored plates you will observe that the protoplasm or the body of the gametocyte stains distinctly blue, and is highly pigmented, while the chromatin granules are stained red, showing that the nucleus seems to be somewhat pushed outward to one side of the parasite. In the upper specimen observe the large size of the ring, and that it only contains one chromatin granule corresponding with the nucleus. The clear area around the chromatin granule is called by Ewing the "milky" zone.

Can Malarial Parasites Always Be Found in the Blood of Patients Suffering with Malarial Fever?—In this case of malarial fever detailed above, in which I observed the malarial parasites moderately abundant in the blood on February 28, 1906, I must also inform you that at an examination made two days previously, in two specimens examined and by two different methods, I found nothing. I have repeatedly found that in selecting the blood, when I used two slides or cover slips, that one of these would show the parasites, while the other one with which the blood was spread would show nothing. Therefore we should always select at least three or four specimens of blood for such an examination. Sometimes at the height of the paroxysm of fever if we select the blood we will find nothing, because at this stage these sporozoa (except in the case of quartan) have a tendency to seek the internal organs such as the spleen, or bone marrow, where they un-





MALARIAL PARASITES—DOUBLE TERTIAN INFECTION.

From a case of tertian malarial fever, in which the parasites had existed in the blood throughout the winter months, and had resisted tonics, and upwards of 200 grains of quinin.

Stained with Woldert's modification of the Nocht-Romanowsky stain, and showing the red chromatin granules of the nucleus and the blue protoplasm of the malarial parasites.

Initial attack of fever began October 24th, 1905; recurrence February 26th, 1906.

dergo segmentation. I have seen in microscopic sections malarial parasites which were literally packed in the blood vessels of the brain. Sometimes during the first day or two of the onset of the fever the parasites may be few, and we may fail to find them.

Again, if one gives quinin it will surely kill many of the parasites, and while only a few may be present in the peripheral circulation, none may be present in the minute drop. of blood on the cover slip. If in selecting the blood a very fine needle be used to prick the skin the blood may not flow out easily, and if one should squeeze the parts they would be apt to press out the oil from the skin, and also watery portions of the blood and tissue juices, and by this means a poor specimen would be obtained which might show nothing.

In selecting the blood one should always use a needle of large size and go deep enough for the blood to come to the surface quickly, and without the necessity of using too much pressure. In certain cases of chronic malarial fever in which quinin has been taken there may be very few parasites in the blood, and none may be found.

In making a microscopic examination of the blood it is absolutely essential that we should know how to spread the blood, and to always be sure that the glass is cleansed and highly polished. Slightly warming the slide as by breathing on it once or twice aids the blood in spreading.

Hasty examinations should never be made, and as a rule one should not give up the search until twenty or thirty minutes have been consumed.

And lastly, the stains which we use may not be working just right, and by this fault we may fail to find the parasites.

So that it is found that there may be at least nine different reasons why we may not find the parasites in certain cases of malarial fever.

But bearing these sources of error in mind, one ought to be able to diagnose correctly perhaps as high as 90 per cent of his cases of malarial fever, while by clinical methods he cannot perhaps do better than to correctly diagnose 50 per cent of such sases.

The Prevention of Malarial Fever—In an address on malarial fever which I had the honor of delivering before the McLennan County Medical Society and Business Men's Club at

Waco, September 12th, 1905, I referred at length to this subject; but I have transgressed my time so far that I cannot go into this phase of the question as much as it deserves. In that address I reported a case of malarial fever who, at my direction, in order to prevent the disease, had about twelve days previously and during a period of two or three days, taken 12 grains of quinin as a prophylactic, but which did not keep off the attack of this disease. I stained the parasites by several different methods and have them with me.

I should very much like to also tell you something of my work done during the fourteen months time spent in the study of the habits and nature of the malarial-carrying mosquito, and how after dissecting dozens of these insects under the microscope, and how after cutting them into 600 pieces, I was able to learn the complete anatomy of the mosquito, colored plates of which I exhibit before you this evening.

But I must press hurriedly on and summarize in a few words just how to get rid of malarial fever, by saying that the direct way would be to destroy all the malarial parasites in the blood of man, or else to adopt the indirect way by destroying all mosquitoes. The best way to accomplish the latter would be to adopt a thorough system of drainage, and supply every two or three weeks to the breeding-ground of mosquitoes, abundant petroleum.

Individually we can do but very little, but such work must be done by an efficient State Board of Health, which Texas needs badly, and must have.

Malarial fever should be classed as a highly infectious disease, such as yellow fever, and every case should be reported to the health department of villages, towns and cities. Patients suffering with malarial fever, as in the case of yellow fever, should be enclosed, especially during the night hours, by means of closely-fitting mosquito bars. It is only necessary to remember that the malarial-carrying mosquito generally seeks its food during the night hours.

Ever keeping before us the high ideals to which we as physicians wish to attain, and remembering that this our dread enemy—malarial fever—annually in this grand State of ours causes the destruction of 3,000 human lives, and millions of dollars in loss of time from illness alone; and being conscious of the fact that our medical profession is the only profession under the dome of heaven whose own combined efforts in

getting rid of disease tends to destroy its devotees; but looking around and observing the havoc of disease and death, of the desolation created by it in the homes of neighbors and friends, and of the sick infant, too, in its mothers arms, who is too frequently the first to be swept away by malarial fever, let us go forth and give battle against our enemy, to the end that our accomplishments will in the course of time permit the mantle of protection to fall upon those who shall live after us, and who may thus reap the legacy which we shall leave to them, consisting of earth's richest blessing of long life, full of prosperity and unbounded happiness.