SEMINAR

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MALARIA

How it conquered civilizations and marched over all who interfered with its destruction only to be in its turn conquered by a handful of scientists and finally put to work by yet another group of workers to give to the mentally demented thier security in life.

Chapter -I-

Its Influence on Civilizations

The dealer of destruction, the spreader of ruin and decay, the molder of history, all these and many more may be written in one word - MALARIA. By its insidious encroachment and persistence it has ruined civilizations and rendered otherwise inhabitable and productive areas uninhabitable and nonproductive.[1] "Where shot and shell have killed thousands Malaria has killed tens of thousands, Malaria is the cheftian in the army of diseases". It has been the contributing factor in the fall of two of our greatest early civilizations - the Grecian and the Roman.

Before 425 BC. Greece produced her greatest military and intellectual men , successfully wagered war against her enemies, and was the leading power in the then known world. However at about the above mentiond date she began a rapid decline. Her people were not the superior race they had previously been. Many have contributed this to their loose morals and intermarriage with inferior races, but certianly there must have been some reason for this immorality, and Binder lays this reason to Malaria. By its severity in the beginning it resulted in many deaths. However as it continued the disease became endenic resulting

I Binder ~~Health and Social Progress~~

in a weakening of the peoples health and making them more ready victims of debauchery and ultimately resulting in their becoming an inferior race physically, mentally, and morally.

Binder gives a similar explanation to the crumble of the Roman empire. When Rome was growing and expanding, her population was made up primarily of the tillers of the soil. These people cared for their own lands and did their own work. They drained many of the swamps to provide more cultivatable land thus resulting in a destruction of favorable breeding places for the mosquito. However as the Roman empire grew and became wealthy its lands fell into the hands of a rich, idle aristocracy. The work was done by slaves who had little care what happened to the lands. As a result they were poorly cared for and the swamps again reclaimed the lands that had once been theirs, making a favorable breeding place for the mosquito. At the same time many people from other lands were coming to Rome, both as traders and as slaves. Many of these peoples came from Malaria areas and were carrying the organism intheir blood-stream. When they entered this area where the anophelene mosquito was undoubtedly prevalent it was inevitable that the mosquito should become infected resulting in the spread of Malaria throughtout the entire population. But the effect of this disease on the Roman was different fromm its effect on the Grecian. [2]"Where Malaria made Greece weak and insufficient, it turned Rome into a blood thirsty brute". This may be clearly seen when one looks at their entertainment of forcing bloody battles among gladiators or between gladiators and wild beasts.

Binder - [2]Health end Social Progress

The reader may ask how it may be proved that any one disease such as Malaria can be the contributing cause in the fall of an entire civilization. Binder refers to the work done by Sir Patrick Manson for his defence. The island of Mauritius located in the center of the Indian Ocean was for many years a health resort because of its pleasing climate and serene beauty. It was the sanitoria of British India for those run down or suffering from some tropical disease. However this serenity was not to continue for long, for early in the eighteen sixties the anophelene mosquito was accidently introduced into this island where, due to favorable breeding places it spread rapidly resulting in a wide spread epidemic of Malaria-- the causitive organism undoubtedly being present in the bloodstream of many of those who sought its quiet shores to regain their health. Malaria has now run its epidemic course in Mauritius and is today an endemic disease on island, resulting in a ruining of a large number of its sanitoria.

If this could happen in modern time to an island colony could not the same happen to an ancient civilization that had become the center of the then known world, receiving peoples and trade from many Malarial areas. Further evidence of the introduction of Malaria into Greece at about 400 B.C. is the failure of non-medical writers prior to this date to make mention of the disease, while following this date reference was made to it by an increasing number of writers. Also at about this same time the cult of Aeschlapius was introduced at Epidaurus- a very Malarial area at the present date-. This further suggests that ill health had probably become quite prevalent. That the cause may have been largely Malaria is strengthened by the fact

that the offerings made following recovery from illness often represented the abdomen, which in the case of Malaria becomes noticeably enlarged, due to the tremendous increase in the size of the Spleen. It then seems quite logical that malaria was very likely the basic cause for the fall of the Greecian as well as the Roman civilizations.

Malaria, as such, was early recognized and described by many of the Grecian and Roman physicians. Hippocrates and Galen in their writings described a disease, characterize by intermittent fevers, which was undoubtedly Malaria. Plattus and Terence in their writings mention the fevers and Cato mentions the black bile and swollen Spleen which are two definite symtoms of Malaria.

Nor is the ancient world the only one mared by this dread malady. Let us look at our times and oun continent. In 1881 DeLasseps incharge of the French engineering company began work on what was to be a great engineering achievment for that company - the building of the Panama Canal. These engineers were not however prepared for the overwhelming obstacles which they met, the leading of these being the two tropical diseases Malaria and Yellow Fever. The workers fell ready victims to these two diseases and death was inevitable. It soon became impossible to bring in more workers due to the fear held of the two diseases and the work had to be surrendered to its victors-Malaria and Yellow Fever. It was not until the conquering of these two diseases thatthe

Panama Canal became a reality.

Malaria does not confine its destructiveness to peace times either. Duringg the world war it held the Macedonian army in its grasp and rendered it almost useless. How greatly this may have influenced the outcome of the World War is not known.

Every year Malaria is costing the southern part of our oun country hunderds of thousands of dollars by its continual weakening of human vitality and rendering sections of land otherwise fertile-uninhabitable.

Zinsser and Bayne-Jones in their discussion of the disease consider it "one of the most comman and wide spread of all infectious diseases, affecting humanity and considered throughout the world it is the cause of more morbidity and mortality than any ather one disease. It is distributed over regions with over eight million population, and in British India alone according to Ross it causes one million one hundred thirty thousands deaths anually".

Chapter -II-

Its True Nature is Discovered

Here, then, we see a disease early recognized by its symtoms marching thru all the ages spreading death, destruction, and pain. Yet because of lack knowledge of its cause and method of transfer little was able to be done to control it.

Bacause it was found around swamps and areas of stagnent water it was generally believed to have been caused by bad air - whence it derived its name - the word Malaria meaning bad air.

It was not until 1880 that the actual cause of Malaria was discovered. In that year a French Military surgeon, Laveran, working in Algeria, described what he believed to be, from observation, the developmental stages of the causative organism of Malaria. He saw and described the pigmented trophozoite and the gametocytes. Because of the movement of exflagellation he maned the organism "Oscillaria malariae", thus classifying it as a filamentous algae. In 1885 Golgi in his work with the organism described the quartan parasite and the following year demonstrated the relation of the stages of the multiplication cycle of the tertain parasite to the temperature curve. Marchiafava and Celli callad the quartan Malarial organism "Plasmodium malariae", thus giving it a definite nomenclature and the one that has since been used for all forms of the Malarial organism.

However the greatest work done in the research of Malaria was done by Major Ross M.D. physician and surgeon in the British army in India. Here Ross was in close contact with the

disease and had ample opportunity to study it. He corresponded with Dr. Manson a physician in London, And the two worked together for a time. Ross first began his work with human Malaria but had little success due to the conflicting ideas still maintained about the disease, its character and method of transfer. He was, however, successful in proving that it was the brown spotted-winged Anophelene mosquito that was in some way responsible for the spread of the diseases. He was working on the idea that the drinking water contaminated with these mosquitoes was the medium of transfer, but for obvious reasons he failed in proving this theory. Ross then turned his attention to experimenting with bird Malaria. He would take infected birds and allow them to be bitten by laboratory grown mosquitoes. He would open a mosquito at various intervals and microscopically examine the walls of the stomach, here he observed the formation of nodules which grew in size, finally rupturing and liberating many small spiral-shaped organisms. These he watched migrate to various parts of the mosquitoes , and especially to the spit gulit. Suddenly Ross realized that here was the method of transference of the Malarial organism, thru the bite of the infected mosquito. To prove this theory he took infected birds and allowed then to be bitten by laboratory grown mosquitoes, he then waited the required length of time for the developmental cycle to take place in the mosquito. At the end of this time he allowed these mosquitoes to bite non-infected birds. He watched these birds develop all the signs and symptoms of Malaria. By this he had proved what the medical world was waiting for,. the method of transference of the Malaria organism thru the bite of the infected

mosquito.

Grassi, in Italy, was also working with Malaria, but after having proved the Anophelene to be the intermediary host of the organism. He set about devising methods by which to prevent infection. By experimentation he proved that people could live healthy lives in malarial areas by careful screening of their houses and staying indoors and behind their screens, especially in the evening when the mosquitoes would come up out of the swamps. Grassi, working with Bastianelli and Bignami in 1898, proved human malaria to be transfered by the same method as bird malaria; this was just one year following Ross' startling discovery. These men also demonstrated the complete life cycle of the human malaria - Plasmodium Malaria. As further evidence of this method of transfer, Manson had several infected mosquitoes brought to London where they were allowed to bite Manson, Jr. and another volunteer, a Mr. Warren, neither of who had ever been in Malarial areas. Both individuals developed the typical tertian fevers and the organism was demonstrated in their blood.

Thus we see how only in recent years and through the hard work of a hand full of medical workers was the actual cause and method of transference of Malaria was learned and proved.

Chapter lll

Life Cycle of the Malarial Parasite

The life cycle of the Plasmodium Malaria is one of interest because it spends part of its time in the human being and part in the mosquito and also because it undergoes such a large number of changes both sexual and asexual. The life cycle may be said to begin with the Sporozoite, the condition in which they are present in the salivary glands of the mosquito. Here they are long slender organisms, each having a central mucleus. It is in this form they are injected into the human through the bite of the mosquito. These organisms show a gliding like movement and enter the Red Blood cell by peristaltic action. After entering the red blood cell, the organism becomes more rounded and becomes known as the trophozoite or growing form. It graduàlly takes the signet ring effect and is ameboid in action. This continues for six to eight hours at which time reddish brown particles called hoemozoin appear in the cytoplasm. This substance is a by-product of hemoglobin digestion. The trophozoites, upon obtaining full growth, undergo cellular division which results in a rupture of the red blood cell liberating many organisms which now become known as merozoites. The Merozoites attack other red blood cells and the life cycle is again begun. This process is known as asexual multiplication or the schozogonous cycle. This cycle continues for several generations when a new form is developed. Certain of the trophozoites acquire distinctive sexual characteristics. They grow slower and there is an abxence of the signet ring effect. The cells do not undergo division but two types of cells are present, The male or microgametocyte and the female or macrogametocyte. In this form they are injested by the anopholene mosquito. The macrogametocytes undergo

intrusion and the microgametocytes undergo nuclear division, and after a period of activity six to eight projects are extruded. These are the micregametes or male sex cells. These organisms swim around and attach themselves to the macregametes resulting in fertilization. A motile capula or zygote termed ookinite is formed. The ookinite establishes itself between the epithelial and muscular layer of the mosquitoe's stomach where it forms a rounded oocyst and grows in size. Nuclear division takes place until twenty to thirty daughter cells are produced at which time the cytoplasm breaks down and sporoblasts are formed. The nucleus in these sporoblasts now divide and migrate to the outer edge forming spindle shaped protrusions which break down forming sporozoites. These sporozoites are motile and migrate to various parts of the mosquito, especially the spit gulit from where they are injected into the human when they bite, and the cycle is again begun. The length of time required for the development in the mosquito depends upon the type of parasite and the temperature. It is known that the malarial organism undergoes degeneration in the hibernating mosquito.

Chapter IV

Clinical Characteristics and Diagnosis

A Diagnosis of malaria is made by demonstration of the organisms in the blood stream. This is done by microscopic examination of a stained blood smear. A differential diagnosis may be made by the difference in the way each type of malaria appears on examination. The plasmodium vivax will show in the trophozoite stage early as a large ring formation in the red cell. Red granules, a blue cytoplasmic ring, and clear vacuoles are also present. Young schizouts are spread over one third of the cell, their shape being regular and they contain few pigment granules - the red cells are definitely enlarged. In old schizout the shape is irregular, but they take up about two-thirds of the much enlarged red cell; there is present one large chromatin mass with many pigment granules. In the schizogony stage it will show the very much enlarged red cell with a regular outline containing two to four and up to twenty-four chromatin masses. The nucleus is divided into the same number of daughter nucleii, each of which is becoming the center of a merozoite. These merozoites are relatively large, irregularily arranged, and have their pigment aggregated near the center of the cell. The gametocytes, of which there are two types, show the macrogametocyte, the female gamete, occupying about four-fifths of a cell which has a more or less regular outline. The cytoplasm is dark blue and the densely stained triangular nucleus is seen near the edge. The pigment granules are coarse and rod shaped. The microgametocytes or male gametes are similar to the macrogametes except they are slightly smaller with paler cytoplasm and a large nucleus, the chromatin is loosely arranged and the pigment granules are finer. The plasmodiam malariae in the trophozoite stage shows the early ring to be much

finer than in the plasmodium vivax, while the young schozout are frequently band shaped and extend across the blood corpuscle. The old schizout are about one-half the size of the red blood cell and are regular in outline often becoming retangular. The pigment granules are coarse. In the schizogony stage, the fully grown schizout is a regular circular or oval taking up about two-thirds of the cell. There is no pigment present. The nuclei are divided into six ot ten parts becoming daughter cells and forming merozoites which are arranged in a circle with the pigment in the center of the cell. The gametocytes are similar to those of the Plasmodium vivax only smaller in size and the red cell is not enlarged. The Plasmodium falciparum shows in the hiophoziote stage a small ring in a red cell of normal size. It may sometimes even show two or more rings. There are often present two chromatin granules in a single cell with the rings at the periphery of the cell and the granules extending over the edge of the rings. The young schizout are similar to those of Plasmodium vivax only smaller and the red cell is not enlarged. There may also be present some large red granules. There are no old schizouts present in the peripheral blood. The schizogony stage is not demonstrable because it occurs in the inner organs especially the spleen. In the gametocyte stage the macrogametocytes are cresent shaped, long and slender, dark blue in color with the chromatin near the center of the cell and the pigment granules closely aggregated around it. The microgametes are kidney shaped, being thicker and paler than the macrogametes, and having the chromatin and pigment widely distributed, covering almost one-half of the area of the body of the cell.

Clinically, malaria may be described as a group of chronic fevers characterized by regular intermittent chills and fever, a progressive anemia, and splenic enlargement. The predisposing causes

are low health conditions, such as those due to excessive use of alcohol or other drugs, chronic illness, or fatigue. The main factor however is living in a district in which there are other infected individuals and the anophelene mosquito is known to live and multiply. The clinical picture shows first an incubation period of nine to twelve days in which the aptient complains of being over tired, has difficulty in sleeping, a loss of appetite and as time advances pain on both sides below the costal margins and in the lumbar region. The fever begins with a chill which corresponds to the release into the blood stream of the parasite, the break down properties of the cell and malarial toxins. The chill usually occurs between midnight and midday and may be accompanied with nausea and vomiting. The chilling usually lasts one-half to one hour and the temperature may go to 103 degrees or over. The chill is then followed by a feeling of excess heat which lasts two to five hours in which the temperature may go to 104 degrees or over. This feeling of heat may be accompanied with a headache and nausea. The hot stage ceases with drenching diaphoresis. The temperature falls rapidly to normal and the patient falls into a matural sleep. When he awakens he may feel quite normal except he feels very weak. The sequalae of malaria may include: 1) enlarged spleen, 2) anemia, 3) sterility, 4) tinnitus, 5) vertigo, 6) deafness 7) neuritis, 8) mental modification. The complications may include : 1) abortion, 2) tuberculosis, 3) lobar pneumonia, 4) amebic dysentary, 5) Typhoid, 6) nephritis.

If malaria is allowed to go untreated in an individual he may develop chronic malaria in which the attacks become progressively less severe and the relapses gradually disappear leaving the patient dyspeptic, anemic, and suffering from an enlarged spleen.

Chapter V

Treatment

The treatment of malarie was known long before its definite cause. In early times the people chewed the bark of the Cinchona tree and found thet they got relief from their paroxism. The drug found in this tree is quinine and is today used as a specific in the treatment of malarial infection. It is in fact so specific that if the fever does not yield within five days after the beginning of the administration of the quinine it is believed not to be a malarial fever. The action of the quinine is due to its attack on a great number of blood parasites setting free an antigen which in turn stimulates the formation of immune bodies which kill the remaining Merozoites. Quinine is oxidized in the tissues and the remainder is excreated by the kidneys. The maximum excretion is between two to twelve hours and by the end of thirty-six hours all of it has been excreted. The quinine treatment is usually continued for a week after the temperature has returned to normal. Quinine may be administered by mouth, intravenously, intramuscularly, or by rectum. Oral administration is the most common and prefered method, however if the patient is in coma, one of the other methods must be used. Of the latter , through intravenous is prefered because it acts more rapidly and there is no danger of development of an abcess due to the irritating effect of the drug. When quinine is given intravenously it should be given in half doses to avoid bringing the patient out of coma too rapidly, resulting in an edema of the brain with possible death. Another danger of intravenous quinine is the development of an albuminurea. As soon as the patient regains consciousness he should be given quinine by mouth. A patient receiving quinine should be watched closely for any reactions or toxic symptoms as a result of an idiocincrasy to or an overdose of the drug. The most important symptoms to watch for are tinnitus, deaf-

ness, giddiness, headache, dilitation of the pupils, and urticaria erythemia. Very large poisonnus doses may cause convulsions, generalized weakness or amblyopia, a condition characterized by dimness of vision which cannot be relieved. Black water Fever, a fatal infectious tropical disease characterized by chills, irregular fever, dyspnea, vomiting, and jaundice, may be a serious complication of continuous overdosage with quinine. When given in case of pregnancy, quinine is very apt to terminate the pregnancy, but as the disease itself will probably have the same effect this is not a substantial contraindication to its administration. Under no conditions should surgery be attempted on a patient suffering with malaria as the prognoses in this case is almost 100% negative. Many medical workers believe that the habit of taking small amounts of quinine should be practiced by all individuals living in malarial areas, as this practice will often prevent contracting the disease.

Other drugs being used with more or less success include Stovarsol, which is given with quinine. The results with this drug so far have been contraindicated. There is often a sharp rise in temperature within the first eighteen hours due to mass killing of the parasite. Plasmochin, a synthetic drug made from quinaline and perscribed for tertian and quartan malaria, may be given with quinine also. Its several advantages over the use of quinine alone include its absence of effect on pregnancy, its lack of relationship to Blackwater Fever, and it may be given when the patient shows an idiocincrasy to quinine. The toxic symptoms which are sometimes delayed twelve hours, include cyanosis due to the formation of methemoglobin and abdominal discomfort. These symptoms usually disappear in two to three days. Experiments are still being carried out to determine the

success of Mercurochrome 202. General treatment for malaria includes the giving of calomel at the very onset of the disease followed with a large dose of magnesium sulphate to rid the liver of the parasites. Malaria may also be treated symptomatically by forcing fluids and giving large amounts of minerals and vitamins to replace those dost during the severe diaphoresis following the chill. Some form of iron or other blood building medication may be administered to help control the anemia which develops due to the destruction of the red blood cells.

Chapter VI

Nursing Care of Malarial Patient

The part played by the nurse in the care of the malarial patient is of utmoat importance, for she is the one who is with the patient constantly. The nurse who cares for a malarial patient must have keen powers of observation and be able to recognize any unusual symptoms and report them immediately. When the malarial patient is admitted to the hospital he should be put to bed and made comfortable immediately, his temperature is taken, and a careful description of his complaints given, along with the length of time he has been having his chills, how close together they have been and how long it has been since he has had his last one. The nurse watches her patient closely and as soon as a chill begins she applies external heat in the form of blankets and hot water bottles. She takes his temperature regularly every hour and keeps an accurate chart of its curve as the temperature chart of malaria is very typical showing a sharp increase and decrease in the temperature every twenty-four or forty-eight hours depending upon the type of malaria. As the patient passes from the chilling stage to the heat stage the external heat is gradually removed and the patient is made as comfortable as possible. At the end of the diaphoresis, which is the termination of the paroxsym the patients bed linen is completely changed and he is sponged to open the pores and make him more comfortable. Fluids should be forced and some type of fruit juice and normal saline given to prevent dehydration and supply minerals, chlorides and vitamines which are needed. A diet of easily digestable, tempting, high caloric foods are given to prevent as much loss of weight and strength as possible. The administration of the medications is the responsibility of the nurse and these she must give promptly and as ordered to obtain the best results. The nurse must make a close observation of all complaints and if there arises any new ones of any importance they should be re-

ported immediately and a close record made of them as they may mean the onset of a complication or a toxic condition caused by an over dose of the medication or an idiocyncracy to it. A close record of the patient's progress is kept for the physician so he may have a guide as to when to decrease or discontinue the medication. After the temperature is down and the quinine has been discontinued the patient is gotten up - gradually at first. When the patient gets up the nurse must watch him closely for any signs of extreme weakness or heart difficulty that would further necessitate his remaining in bed, for it must be remembered that this individual has just recovered from a long depleateng illness. After being up a few days without showing any signs of symptoms of complications the patient is allowed to return home where he continues his convalesence .

Chapter VII

Pathological Changes

Malaria causes pathological changes in many of the organs of the body. The blood shows a marked anemia with the red blood count down to two million or even less. The color index may be down to one or less. The white blood count may be normal or it may show a leucopnea with as low as four thousand white blood cells. A differential count shows an increase in mononuclear leucocytes to as high as fifteen per cent. Some pigment is found in the blood. This is set free in the destruction process of the red cells and is considered of diagnostic importance. The age of the pigment may be determined by its appearance. At first it is in the form of fine granules and found in the connective tissues of the liver, the parenchymal cells of the spleen, and in capillary epithelium. As it grows older it is found in large masses in the hepatic connective tissue and splenic parenchymal cells. Finally it forms blocks and is absorbed and disentegrated by the cells.

In the brain pigmented leucocytes may be found and if sporulation occurs in the brain capillaries thrombosis occurs which results in a cerebro-vascular accident.

The spleen, the organ which is the blood filter, is the organ most damaged by malaria, and is the organ which may harbor the parasite for many years resulting in recurrent attacks of the disease. The spleen becomes enlarged to many times its normal size and becomes subject to easy rupture resulting from a blow on the abdomen. The splenic swelling is due to the presence in that organ of a large number of red blood cells containing parasites, and white blood cells which are fighting the parasites.

The liver may undergo cloudy swelling, atrophy, and even necrosis in severe attacks. The pigment is caught in the kupfer cells of the intercolumner cells, but does not enter the cell proper.

The intestines are affected in the choleraic type and may undergo ulceration and bleeding caused by sporulation taking place in the intestinal walls.

In the kidneys may be found deposition of pigment in the glomarular capsules or connective structures. The parasites are however very rarely found in the kidneys.

The malarial parasites may become infiltrated in the bone marrow where they will remain quiescent for long periods of time.

The organs may be listed in order as places of attack for sporulation as follows: brain, lung, spleen, bone marrow, liver, and intestine.

Post-mortum examination of malarial patients have revealed many interesting facts.

In cerebral types of malaria the brain and spinal cord may be laden with color and show punctiform hemorrhages. Hyperemia and edema of the leptomeninges is also found as well as pigmentation in the brain cortex. Pin point hemorrhages are often demonstrable in the subcortical white matter. Hemorrhage is fairly common in the retina of the eye.

The spleen is found to be greatly enlarged and the capsules are thichened. The pulp may be conjested and even viscuous.

The liver may change to a slate or plum color. It is definitely enlarged and often shows a peri-hepatitis. The gallbladder is usually distended with a large amount of dark bile.

The intestinal walls develop a slatey blue color except in the cases of the algid type in which the mucous membranes become conjested. When dysenteric signs have been present the bowell contents may be blood

tinged and contain mucous flakes and particles of membrane.

If the malaria has been of the renal type the kidneys may show cloudy congestion, swelling of the parenchyma punctiform, and hemorrhage into the kidney pelvis.

Chapter VIII

Malarial Treatment of General Paralysis of the Insane

Malaria is now repaying in part some of the damage it has done and is doing. In 1917, Wagner Von Jauregg, an eminent Austrian scientist, set farth the idea that General Paresis in many cases could be cured or improved by a febrile disease of which Malaria seemed to have the best results. He had noted from abservation that certain individuals suffering with paralysis of the insane had, after naturally acquiring a febrile disease, regained their sanity and continued in the same positions they had previously held. Jauregg was not the first scientist to make these observations, for as early as 1848 Koster noted that certain patients suffering from mental disorders improved noticeably after having accidentally acquired Malaria. In 1887 Jauregg first made his observations regarding the favorable effects of malaria on the Central Nervous System Syphilis and especially Paresis. In 1917 he first put his observations into actual practice when he caused nine patients suffering with General Paresis to be artificially innoculated with Malaria of the Plasmodium vivax strain. Of these cases one died of epileptic paralytic attacks before the conclusion of the treatment, two were uninfluenced, and three remained in complete remission and were able to continue their work. Jauregg continued his work with favorable results with an average of about thirty per cent complete remissions and twenty per cent incomplete remission. Terraro Dante, another physician who early made use of Malaria in the treatment of General Paresis, reported from 3193 cases treated - thirty per cent complete remissions in which the individual returned to his previous walk of life, twenty per cent marked but incomplete remisions in which the individuals showed definite improvement, twenty per cent in which there was no change, and death resulted due to the Malarial infection in about ten per cent of the cases. Though this may seem like

a startling high mortality for a treatment, it must be remembered that these figures were published early in the development of the treatment and since that time the treatment has become better standardized so that the mortality is now much reduced. Today the calculated percentages of complete remissions following the treatment with Malaria vary from thirty to fifty per cent depending upon the length of time the individual can stand the fevers and the severity and length of time they have been suffering with Paresis.

The methods of infection are by use of the laboratory grown and infected mosquito or by intravenous or intramuscular injection of blood from an infected individual. Great care must be taken that it is a pure strain of Tertian Malaria used as this is the easiest type to control with quinine and the least apt to be fatal.

When the intravenous or intramuscular method is used the blood should be used within twenty four hours from the time it is taken to be effective, and if it is not given immediately it should be citrated. The amount used is usually two to four centimeters and because it is so small in amount it need not be cross-typed as no harmful effects will come from using blood of an apposite type.

Patients who are about to receive therapeutic malaria should have a very careful physical check up to see if they are able to withstand the disease, for it must be remembered that these people are already suffering from one disease and the addition of another may be too much for their constitutions. Contraindications to artificial innoculations with Malaria include the following: Cardiovascular disease, a comparitively common complication of syphilis, should be given eareful consideration before giving Malaria as the increased load on this sys-

tem by the second disease may cause rupture of an aneurysm should there be one, or failure of the cardiac muscle. There may also develop cerebral hemorrhage with the development of hemiplegia or even death as a result to the Malarial Paroxysms. Anemia is another definite contra-indication for malarial treatment, for we know that Malaria itself is conducive to anemia and were it given to an already anemic individual the results could easily prove fatal. A red blood count of three million of less does not warrant the use of Malaria in any case. Emaciated individuals should not be given Malaria as the depleting effect of the fevers would only increase this condition and the patient would have difficulty withstanding the treatment.

The symptoms of metabolic diseases may be accentuated by Malaria and for this reason it should not be given to individuals suffering from metabolic disturbances. Cardio-renal diseases, arteriosclerosis, diseases of the liver and spleen, chlorosis, Banti's disease, Gaucher's disease, and jaundice of any type are all contraindicative of therapeutic Malaria as well as such chronic diseases as tuberculosis, carcinomatoses conditions, Hodgkins'diseas, chronic lead poisoning, arsaphenamine dermatitis, or dermatitis exfoliation of any kind.

The utmost care may be taken in selection of cases for theraputic Malaria. It is inevitable that some patients will develop some type of complication. Of these complications anemia is probably the most common, developing in almost all the cases and in some patients very rapidly. In cases of development of anemias the Malaria should be terminated immediately with quinine and the patient given large amounts of protein foods and transfusions if necessary. Jaundice may occur in more or less severe degrees, but unless very severe and accompanied by other symptoms , is not an indication for early termination of the disease. An increase in blood urea is another relatively severe complication and

for this reason the urea nitrogen should be checked frequently and if it should reach or exceed seventy milligrams per one hundred cubic centimeters the Malaria should be terminated. In some cases a fall in blood pressure may develop and if the systolic pressure falls to one hundred there should be extreme care exercised and if it falls to ninety systolic, termination is warranted. Emotion may occur in some individual due to uncontrollable diarrhea, pernicious vomiting, and inability to take food or fluids by mouth. There may in some cases be an occurrence of such vascular accidents as rupture of an aortic aneurysm, hemorrhage encephalitis, paralysis of the cardiac center resulting in death due to heart failure, or cerebral-vascular accidents resulting in a hemiplegia of varying degrees, depending upon the extent of the hemorrhage. Also during the course of the Malaria, many or all of the symptoms from which the patient has been suffering may be greatly accentuated. There may result extreme restlessness with, in some cases, delirium, and hallucinations. There may occur severe heaeaches, sharp shooting pains and sensations of loss of bladder and rectal control. However, these symptoms usually leave at the end of the treatment. Deaths due to therapeutic malaria have now been brought down to nearly five per cent which is the report given by most investigators. Autopsies following death have not always been able to acertain the cause of the death, , though in most cases they have been found to be due to severe emaciation, anemia, rupture of an aortic aneurysm or of the spleen.

The curative action of Malaria is due to susceptability of the treponema pallidum to increases of a few degrees in temperature about the normal body temperature. Thus the high temperature reached during the malarial paroxysms burn out the syphilis organisms. The course of theraputic malaria is usually quite similar to that of acquired Malaria except, because it is a pure strain, the paroxysms come at regular intervals, depending upon the type of Malaria used.

Following Malarial innoculation the patient is kept relatively quite and watched closely. The first chill will probably occur on about the fifth day following innoculation ang every fourty eight hours after that time if it is the pure tertian strain, this beeing the one usually used. During the chill the patient is treated the same as if he were suffering from the naturally acquired malaria. During the course of the treatment it is essential that a close check be kept on the patients condition for it must be remembered that the patient is suffering from two and not one disease. If no complications develop the patient is allowed to have ten to fifteen paroxysms depending upon the length of time the fever is up and to what degree it goes. When the physician feels the patient has had sufficient therapy he terminates the malaria with large dosages of quinine. Usually five grams given in the first seven days is sufficient to clear the blood-stream of the parasites, tho for added precautions smaller doses of quinine are given for atleast one more week. Usually by the second week the patients strength has returned enough for him to be up and about some. The length of time required for relief from the mental confussion to normal or approxiamately normal if the patient is to get remission, varies from the time of termination of the treatment up to one years time. The success of the treatment can not be accurately predicted in less than a years time.

Wagner-Jauregg developed a modified technic of malarial treatment for those patients he felt were not strong enough to with stand the rigors of a full malarial course. This technic consisted of giving the innoculations in two relays. Quinine in very small

doses is given to reduce the severity of the rigors, usually after about four rigors enough quinine is given to cause a discontinuation of the rigors for a short time to allow the patient to rest and build up his physical condition. The rigors will usually again resume spontaneously, or if they do not then the patient is reinnoculated. This technic has made possible the giving of malaria therapy to patients who would other wise not be able to undergo the severity of the staight malarial treatment.

Tho it is a well known fact than nerve tissue does not regenerate its self this seems to be the exception, for it has been found on autopsies on patients who have recently undergone malaria therapy that there are definite histological change in the brain tissue. Dr. Grestman reported from thirty eight cases who had died shortly after termination of the treatment that there was marked regression, and the paresis in some ceses was hardly recognizable. He reported definite healing prosesses as taking place in the brain substance.

Nursing care of patients who are receiving therapeutic malaria includes all that is done for the patient who is suffering with naturally ecquired malaria plus many adde precautions. In the first case the nurse is dealing with a patient for whom everything is being done to terminate the disease, while in the second case the disease must be allowed to run a certain course before the disease can be terminated. Then to the second case is already suffering with a degenerating disease. Constant watch must be kept for the rise of complications and these must be reported immediately, as they may necessitate immediate termination of the disease. This patient must be reassured and his anxiety relieved, for it must be remembered

he is already mentally ill and this added disease in many cases ac-centuates his mental symtoms. He may feel he has been taken advantage of and given some other disease just to make him feel worse, and that everyone is plotting against him and no one is on his side. The nurse and everyone associating with him must make him feel he is among friends and that he will soon be well and able to return to his home. At times the patient may become irrational and require restriants to keep him under control, in these cases added sedation is also given in order to keep him quite.

At no time should the nurse allow the patient to know what feelings she has, if such exist, toward the syphilitic patient, for should she make him feel there is a stigna attaked to his condition he may become very depressed and loose all desire to live. If the senses that her patient has any such feels she must reassure him and make him realize that it is a thing that can and does happen to many people. The nurse must in every way prepare this patient to go back into active life and resume where he lelt off. For the observant interested nurse the termination of the malaria is of utmost interest, for even at this time in some cases improvement changes may be noted, and the interested nurse is going to be the first to noted these changes. She is going to have the pleasure of knowing that this patient may be able to go back and pick up the threads of live where he left off and enjoy added years of healthful happy association with his friends.

Chapter IX-

Case Study of Patient Receiving Malaria Treatment of Tabo-paresis.

Mrs. X is a thirty year white prostitute. She ia rather attractive tho coarse appearing and has a strong odor of cheap perfume. Her past medical history is essentially negative except for an appendectomy when she was eighteen and an extensive gynecological operation in 1929 as a result of acute and chronic gonorrheal infection. She has not menstrated since this last operation. She first know she had syphilis five years ago and since that time has been receiving salversan and bismuth injections. She denies ever having had any primary or secondary lesions. She has received little relief from her anti-luetic therapy and it was decided she should have of malaria therapy. On January twenty-third she was given three cc of malaria blood and sent into the hospital. Upon admission she complained of chills and hot flashes, however this was not accompanied by a rise in temperature; this could have been a mental reaction to the injection and may have been on a neurotic basis. In her history she statedthat she had been suffering with some lapse of memory for recent events for the two or three years. She has had no dificult withswollowing or talking.

She was put to be with bed-rest and given a general tray, fluids adlib, and phenobarbital at h.s. for rest. By February 14, Mrs. X had not had any chills and it was felt the malaria treatment had failed. It was recommended that she be discharged and return to the out-patient clinic.

She was re-admitted to the hospital on April 27, complaining

of chills. She stated she was given a second malaria innoculation in the out-patient clinic four days previously, on the twenty-third of April. On April 29 she from a chill and fever, her temperature reaching a peak of I04.4 degrees at seven o'clock A.M. The following after-noon she had her next chill, her temperature reached a peak of I05.4 at three o'clock P.M. Her third chill following admission she had on the second of May, her temperature reaching its peak of I05 degrees at nine o'clock A.M. On the fourth she had her next chill with an elevation of temperature to I04 degreea at three o'clock A.M. The following night at midnight she had her next chill with an elevation in temperature to I04.4 degrees. May eighth at seven o'clock A.M. she had her next chill with a temperature of I04 degrees. It may be seen from this that with a few hours variation she has had her chills approxiamately every fourty-eight hours. Her temperature during the chills have not gone as high as was desired and it is questionable how successful the treatment will prove.

Her orders on admission were bed rest, general diet, fluids adlib, phenobarbital 90 milligrams at h.s., external heat when ever she need it, and tepid sponges if her temperature went over I05 degrees.

On the twenty-eighth of April she was given Codiene 60 milligrams and A.S.A. grams 0.6 every three hours for five days. This was given for pain, headaches,and restlessness.

On the evening of April thirtieth she became irrational and difficult to control.For this she was given 20 cc of paraldehyde with oil as a rectal retetion enama. This was ordered to be repeated in six hours if the patient did not become quite. Mrs. X finally became quite about two hours after she was given her first enama.

On the third of May she developed a rash on her arms, hips and thighs. It was a red vascular rash on an erythemaeous basis. It was felt this was probably due to the barbital. This medication was discontinued and calamine lotion with phenol I% was applied. She was given sodium bromide grams I at h.s. in place of the phenobarbital.

On May fifth she again became very uncontrolable and was given an HMC #I stat in the evening. This quieted her and she had a quiet night. On the eighth if May third her Codiene and A.S.A. order was rewritten and changed to be given every four hours for three days if she needed it for a headache. Mrs. X presented a definite medical and nursing problem, for the malaria seemed to make her irrational and uncontrollable. Itt is necessary that the nurse keep a close watch over herto prevent her doing anything injurious to herself or the other patients. Her nurse must be a friendly sympathetic person who will try to talk to her patient, and quiet and steady her and help to make her realize where she is and help her become orientated. For this patient it wassnecessary that she have a strong sedative to quiet herand keep her from wearing herself out. Mrs. X suffered from severe headaches which is quit comman in malaria cases, especially at the beginning of the chill. Mrs. X's hemoglobin is holding up well thus far in the treatment having had no drop in either the R.B.C. or the hemoglobin. She is taking food and fluids fairly well and thus has had to have no intravenous or subcutanous fluids.

Mrs. X treatment will probably be comtinued to twelve or fifteen chills at which time it will be terminated by

quinine in the afore mentioned method.

What the ultimate outcome of this treatment will be for Mrs. X is not known, but it is hoped as in all cases that she will get complete remission.