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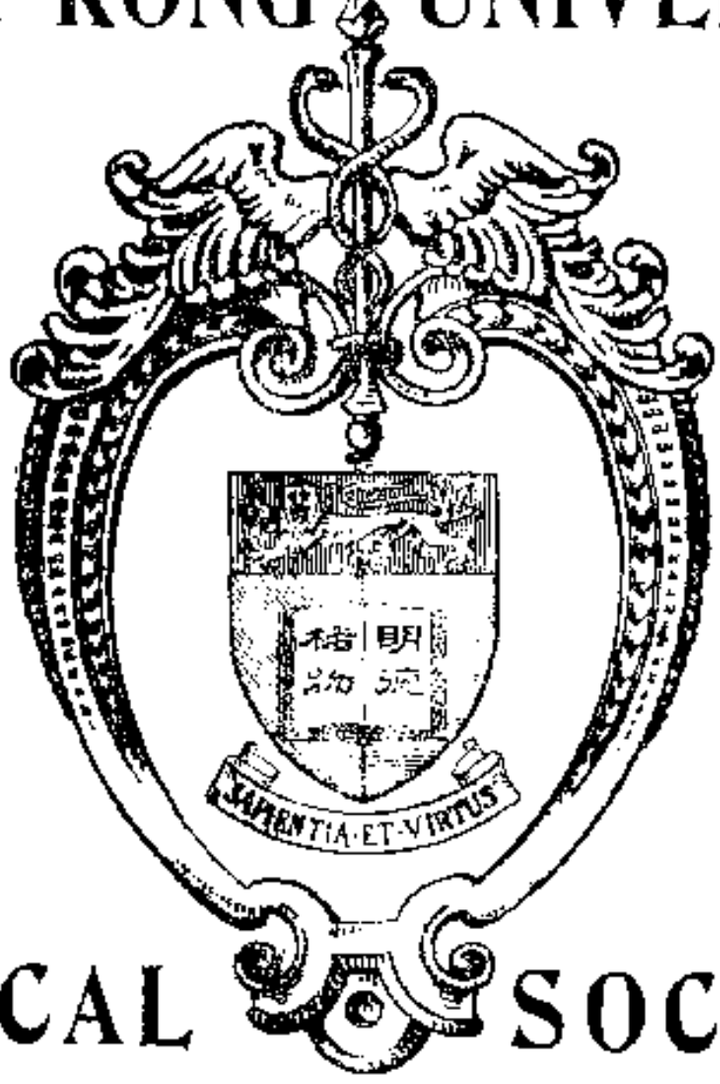

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THE CADUCEUS

JOURNAL OF THE HONGKONG UNIVERSITY MEDICAL SOCIETY.

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THE LIFE HISTORY OF MOSQUITOES.*

by

A. R. Wellington.

Mosquitoe, is a Spanish word meaning a little fly. Furneaux states "One of the most interesting of the aquatic diptera is the Common Gnat the merry flight of which is well known to everybody. There are many, however, to whom the familiar name recalls something more than a lively movement in the still summer-air. It suggests sensations which leave a more lasting impression – a gentle buzzing sound in the neighbourhood of ones ears, followed by a sharp stinging sensation on some tender unprotected spot. But the insect is as interesting as it is troublesome and one forgets the tantalising bite of the creature when its exquisite beauty is displayed beneath the lens."

It was a true naturalist who gave that description and he was quite right about the exquisite beauty of many of the species—It is is no exaggeration to say that they are just as beautiful as birds—even though their colourings be confined to shades of black, brown and white.

Mosquitology or the study of mosquitoes is a very big subject. Thirty years ago the scientific knowledge of these insects was confined to a few naturalists and even they knew very little about them. Medical men saw in them only a nuisance to comfort and the origin of certain skin troubles through infection of the wounds made by their bites. The ordinary man in the street only knew that they hummed and that they stung. He had no idea that there were more than one species but he did know that the new comer suffered more than the old stager.

You have all heard the story of the Governor who made a habit of having at his dinner parties one or two fresh cadets to act as attrac-

* Lecture given at Helena May, Hong Kong 18th February, 1930, H.E. the Hon. Mr. W. T. Southorn, Officer Administrating The Government, being in the chair.

tion spheres for the mosquitoes so that His Excellency should escape from their attacks.

It was Manson, one time a Private Practitioner in Hong Kong, who first directed the attention of medical men to the fact that mosquitoes carried a disease called "Filaria" from one person to another and to the theory that the very important and wide spread fever called Malaria was due not to emanations from swamps but to the transmission of a germ from man to man through the medium of the mosquito. Ross in a brilliant piece of research work proved the theory and demonstrated that the transmission of malaria is not a simple process in which the proboscis of a mosquito acts as an inoculating needle transferring blood containing malaria direct from one person to another but that an interval of 10 days must elapse before the insect can transmit the disease. During this interval the mosquito itself becomes infected with malaria the parasites multiplying a million fold in the tissues of its body. In ten days time, not before, the parasites appear in the saliva and it is then and then only that the mosquito can pass the disease on to a human. The spread of Malaria is thus from man to mosquito and from mosquito to man. It takes a man ten days to incubate the disease sufficiently to show symptoms and infect a mosquito and a similar period must elapse before that mosquito can infect another man.

It was thought, at the time, that Ross had discovered the key to a simple means for eradicating Malaria—all that was necessary was to exterminate the mosquitoes. It seemed simple and medical men and others with the scantiest knowledge of mosquitology commenced to put theory into practice. The results in most cases were failures —in some worse than failures for malaria increased. A great deal of money had been wasted. Something was wrong with the theory said the workers, something was wrong with the workers said Ross and his disciples.

Then commenced that detailed investigation and research which has proved that malariology is bound up with mosquitology and that mosquitology, far from being a petty subject of narrow limits, is one of vast magnitude in which a man can spend a life time and still have something to learn.

What Ross had discovered was not the solution of the malaria problem but the key to the science of malaria prevention—a very different thing.

Thirty years of investigation by many different workers has added an enormous amount of knowledge of the subject and new facts are being brought to light daily.

In 1900 the number of medical men interested in mosquitoes could almost be counted on the fingers, now it is considered essential

for every tropical worker to have some knowledge of the subject and for every one engaged in health work or preventive medicine to have a practical knowledge of the habits and life histories of the local mosquitoes especially of those which carry disease.

Anyone can learn something concerning the local mosquito fauna if he goes the right way about it. In health work the willing co-operation of the people is of great practical importance—and the more the populace knows of the subject the greater will be the chances of co-operation. If every person could be made to understand the life history of mosquitoes and the diseases these insects carry there would be less breeding places and less disease. Considering the importance of the subject it is surprising how little the average European knows of mosquitoes. I will tell you a short story to prove this point. A new man just off the ship was being initiated into the mysteries of the East by the junior members of the mess he had joined. In the evening they showed him his bedroom where a tennis net was carefully arranged about his bed. This he was informed was a necessary precaution against mosquitoes and he was warned to tuck himself in carefully. In the morning when he appeared at breakfast with his face all spotted he was asked had he slept well and they hoped the mosquitoes had not troubled him. He replied that he had not noticed any mosquitoes but the midges were something awful.

Gnats are mosquitoes and mosquitoes are gnats but midges though closely allied really belong to another family.

Mosquitoes are described by entomologists as belonging to the family culicidæ of the order of diptera which in ordinary language means the family of gnats or mosquitoes which occupies a place as one of the divisions of the order of two winged flies. They are distinguished from all other flies by having scales on the body and wings.

Mosquitoes are insects or animals in which an outer shell or exoskeleton takes the place of the bones or endoskeleton of higher animals. Like many other insects they have a metamorphosis in their life history. Starting as eggs they pass the growing part of their life in water as wrigglers or larvæ, in the adult stage they are ærial insects with wings.

In the larval stages mosquitoes can be compared to fish—in their adult stage to birds. The larvæ are like fish in that they live in water through which they propel themselves by wriggling movements of their bodies. Like fish they have the property of extracting what oxygen they need from the air dissolved in the water. Most books say the larvæ must have free air to breathe but I have proved this to be false by keeping larvæ in bottles full to the brim with water and the bottles tightly corked. The only air in the bottle was that

dissolved in the water yet the larvæ remained alive for 24 hours, in other words, until the dissolved air had been used up.

Some species such as the anophelines have larvæ which closely resemble fish in general appearance—in other species the resemblance is not so marked. Each larva has a head, a thorax, and an abdomen and each has fin like appendages.

In their adult stage mosquitoes are like birds in that each has a bill or proboscis, a head, a thorax, an abdomen, wings and legs. Birds are distinguished the one from the other by size, shape and markings and so are mosquitoes. Birds have feathers and mosquitoes have scales which correspond to feathers. Every species of bird has its own favourite nesting places or places where it deposits its eggs and the same can be said of mosquitoes. Some birds live in close association with man and so do some mosquitoes. Some keep as far away from him as they can and likewise do some mosquitoes. Certain animals have an attraction for certain birds and the same applies to mosquitoes. Some birds seek their food by night and some by day—most mosquitoes feed at night, but some feed by day. Birds have their favourite meal hours and so, to a certain extent, have mosquitoes.

The snipe has a long beak which enables it to pierce the crust and get nourishment from below the surface and it has long legs to allow it to manœuvre among the reeds and grasses. The mosquito has a long beak which allows it to pierce the skin and long legs which permit it to manœuvre among the hairs of an animal and at the same time to keep its wings free so that it can immediately seek safety in flight.

Mosquitoes vary in size according to species but an average specimen is about 3/8ths of an inch in length measuring from the tip of the proboscis to the end of the tail. Of the total length 1/3rd is occupied by the proboscis, 1/3rd by the head and thorax and 1/3rd by the abdomen. They are slender insects whose width of body is only 1/6th its length.

Many people including even medical men are of opinion that there are only two or three kinds of mosquitoes. In actual fact the number of distinct species is something in the neighbourhood of two thousand.

This great family of mosquitoes can be divided into three sub-families viz. the anophelines, the culicines, and the stegomyias or ædes. The species of anophelines number 150, the stegomyias some 20 species and the rest may be classified under culicines.

Each of these families can be distinguished from the other in the egg stage, the larval stage, stage, and the adult stage—and the same can be said of most of the species.

Some of the species are rare, some are wild and live remote from human beings, some frequent the haunts of man but never touch him—others feed on him without doing him any harm. But there are a few which act as media in the spread of disease.

Metamorphosis.

In its life history the mosquito passes through four stages, the egg, the larva, the pupa, and the imago or adult. The last is terrestrial, the other three stages are aquatic.

The time spent in each stage depends on a number of circumstances, but given the optimum conditions with regard to moisture, temperature and food the average duration of metamorphosis may be said to be 15 days—of which 2 days represents the egg stage, 10 days the larval stage, and 2 days the pupal stage.

Under adverse circumstances the period of metamorphosis may be prolonged into months—if the conditions be too severe death occurs.

There has been considerable discussion in philosophical circles at different times as to which came first—the hen or the egg—and had they taken the same interest in the mosquito as they did in domestic fowls there can be no doubt these same philosophers would have had just as heated debates concerning the mosquito and its egg. It is at first natural to suppose that the egg came first but then the difficulty arises as to what laid the egg.

As, however, most people are sure they have seen adult mosquitoes and felt them too and as some have not seen the larvæ and very few the eggs. I will commence by describing the imago or grown up mosquito.

The Imago or Adult.

Anatomically the insect may be described as consisting of a head, a thorax, an abdomen, a pair of membranous wings and six pairs of legs.

The head is more or less globular and conspicuous upon it are two large eyes. Projecting from the front are five structures—the proboscis or piercing organ in the middle with the palps and antennæ on either side.

The proboscis contains the piercing organs or tusks and the sucking tube or trunk. All are contained in a sheath which is called the "Labium."

The palps are appendages which project from the head on either side of the proboscis. The palps of the males are clubbed at the end and are as long as the proboscis in all mosquitoes. The palps of the females are not clubbed—in the anophelines they are as long as the

proboscis—in the other genera they are quite short. Some mosquitoes have markings on the palps which serve to distinguish them.

The antennæ are long and slender. In the males they are covered with bushy whiskers, in the females there are only a few hairs.

The piercing organs consist of two swords, two saws and two spears, so that the mosquito is well supplied with weapons for getting through the toughest hide.

The females only are the vampires, the males are much more gentle and neither bite nor suck blood.

Each mosquito has a pair of membranous wings and six pairs of long legs. Some mosquitoes are plain but others are beautifully marked on their palps, on their bodies, on the wings, and on their legs.

One can tell an anopheline from all other mosquitoes from its stance when resting. The anopheline in its resting stage appears to be standing on its head. It has its proboscis, its head, its chest, and its abdomen all in a straight line—like a good diver taking a header. The other kinds of mosquitoes rest with a humped back and with their chests and abdomens more or less parallel with the plane on which they are resting.

The Eggs.

The eggs laid by a female at a sitting vary in number from 50 to 300. As the time interval separating each generation of egg layers is only three weeks it is obvious that provided all eggs hatch and the progeny reach maturity the increase is extraordinarily rapid. The rate of increase can best be realised by saying that before two months has elapsed a mother could have one million descendants.

Luckily for us the rate of destruction is also rapid. Many of the eggs are destroyed before they are hatched. Under natural conditions only a small percentage of the larvæ ever reach maturity and become imagoes and of those that do many succumb before they have a chance of depositing their eggs.

The egg of an anopheline is shaped like a life boat with an air chamber or float attached to each side. The egg of the stegomyia is something like a grain of rice in shape but of course much smaller. Culex eggs are cigar shaped—and collected together like a bundle of cigars into what are called egg rafts. There are several hundred eggs in each raft.

The Larvæ.

After a time varying from a day to weeks, the duration depending on the temperature of the water, the egg hatches and a tiny wriggler or larva emerges. The larva is at first naked and tender

like a new born babe but in a short time through the action of certain cells in its skin it sweats out a fluid. This fluid, which covers the entire body, solidifies to form a hard shell like substance called "Chiti." It is the same material as that which forms the shells of beetles. This suit of clothes does not stretch and the larva growing inside soon becomes too big for its clothes. When this happens, the larva moults and throws off its tight suit and sweats on another one. This happens three times before it becomes fully grown.

The general shape of the larva differs according to the family it belongs to. Anophelines more closely resemble fish in appearance than do either the stegomyias or the culicines. The difference in shape is necessary because of the difference in the food supply of the three families. Each larva can obtain sufficient oxygen to keep it alive for a considerable period from the air dissolved in the water—but each prefers to get its oxygen direct from the external air.

Anophelines are surface feeders—that is—their food is derived from minute particles or organic matter floating on the surface.

The stegomyias and the culicines obtain their food from particles which are either suspended in the water or are swimming through it.

Anophelines are shaped more or less like fish and they lie flat on the surface feeding and breathing. They feed by the head but they breathe through two openings called spiracles on the back near the tail.

Culicines and stegomyias or ædes having to obtain their food at planes beneath the surface lie in an oblique position with their heads submerged. To allow of greater freedom in feeding and at the same time give free access to the atmospheric air nature has provided trunk like appendages or breathing tubes which connect the body with the surface and which contains the air tubes. At the distal extremity of the tubes are the spiracles or nostrils.

Anopheline larvæ are easily distinguished from stegomyia or culicine larvæ by the fact that the former have no breathing tubes and that they lie on the surface of the water.

Water does not enter the breathing tubes—any oxygen obtained from the water is through the gills which are atrached to the tail—behind and below.

The Food Supply of the Larvæ.

The food of the larva normally consists of microscopic algæ, animalculæ and particles of organic matter which are floating on or suspended in the water. Like higher animals and even humans—each species has its own favourite food—particular varieties of animalculæ or algæ which flourish in particular varieties of water. Exactly

what influences species in the choice of food is not known—probably fashion and tradition have a great deal to do with it. Originally there probably was a reason for choosing a particular food and a habit was formed which stuck and was handed down from one generation to another. Whatever the reason was the fact remains that one species frequents one kind of pool and the explanation is a preference for a particular food which is found there. One can however rear most larvæ to maturity in tap water to which has been added a few blades of fresh grass.

The method of feeding is peculiar. By rapid movements of its mouth brushes or whiskers the larva sets up a current in the water adjacent which current passes into the mouth from the front and out of it at the side. The action is similar to the coolie who pushes in his rice and fish into the front of his mouth and spits out the bones from the side.

The larva can reach maturity in eight days if the temperature be favourable and the food supply good— but they may remain for months as larvæ if the water is cold or the conditions otherwise unfavourable.

When the larva has reached its maximum size it becomes discontented with its position as a poor fish and longs for a chance of seeing more of the world. It finally makes up its mind that it will cease to be a submarine and will become an aeroplane. It throws off its coat and sweats out a room or workshop in which it shuts itself up—leaving two windows through which to see what is going on outside. It decides to dispense with water as an oxygen carrier and to get it direct from the air. For this purpose it provides two chimneys—so that the workshop shall be properly ventilated. Being too busy to eat it makes no provision for food. The workshop and the animal within it is now called a "pupa."

Only 48 hours is allowed for the change from a submarine to an aeroplane and work has to go on night and day without a rest. The thorax has to be fitted with wings to allow the insect to fly and legs to allow it to launch itself and to land with safety. The head has to be armed with saws and swords and spears to pierce the skin of the prospective victim and with a trunk to suck up his blood. Everything has to be completed in the security of the workshop otherwise there is a chance of the machine crashing.

When everything is complete the pupa splits down the middle of its back. In other words—the roof of the workshop divides in two and the completely formed and completely grown ærial insect or æroplane pushes its way out of the shop through the opening in the roof. The chest or engine comes first, then the feet or props, then the wings and finally the head and its armourments. When

all has emerged the insect rests its weight on the now empty workshop and spreads its wings (until now wet and flexible) out to dry and harden.

Bionomics.

Like higher animals each tribe or species has its own mode of life and its own peculiarities. Each has its own manners and customs and its own likes and dislikes regarding environment, range of action, food, and hours of feeding—light and temperature.

With regard to environment—some species are wild and live in remote parts of the jungle far away from the haunts of man—while others are domestic, that is, live in close proxmity to him. Aedes Egypti—(Stegomyia fasciata) the yellow fever carrier has such a liking for humans that it lives and breeds on the premises and seldom is it found more than two hundred yards distant.

With regard to water environment for the larvæ—some like stegomyia are only found in that contained in artificial receptacles such as tins, coconut shells, or barrels, or cisterns, or gutters. In Panama the most important of the breeding places of the stegomyia mosquitoes which spread the yellow fever were situated in and about the hospital. The bed posts of the yellow fever patients were placed in cups of water to prevent the ants from crawling up and disturbing the patients. In these cups the stegomyia laid her eggs and in these cups the larvæ developed to maturity. At night the nurses carefully closed the doors and windows to keep out the swamp air which they thought caused the disease, shutting in the mosquitoes the real carriers. Outside in the tropical gardens were innumerable flower pots each containing a beautiful flowering plant and each resting in a saucer of water. The water in the saucers was alive with wrigglers. There in the hospital premises were all the factors for the spread of the disease and neither the doctors, the nurses, nor the patients were aware of the facts.

Some species develop in nature in clear waters, some in muddy waters, some in waters highly polluted with organic matter, some in brackish water. Some are only found where the water is in deep shade, some only in water open to the sky. Exactly why each species chooses a water of a certain character in which to deposit her eggs is not known. It is probable that there is a certain amount of custom or fashion about it for in the laboratory it is possible to rear larvæ in waters which differ considerably from those in which they are found in nature.

The same applies to birds. We do not know why one bird chooses a certain kind of tree for its nest but we know they do have *preferences*—and we know that their young can be brought up under conditions which are far removed from those the parents would choose

in nature. Human races have preferences in the matter of dwellings —so why not mosquitoes?

It may be that certain waters contain the particular food for which a particular species has a partiality, on the other hand, it may be that certain waters contain germs of disease which are fatal to some species and to which other species are immune. However, whatever be the reason, the fact remains that different species select different waters for the development of their young and seldom will they be found in those of a different character.

Certain large black culicines, which bite fiercely, bring up their young in water heavily charged with rotting organic matter such as the liquor of manure pits.

There are large mosquitoes, called elephant mosquitoes because of their size, whose favourite creches are the water which collects in the bottom of the orchids known as pitcher plants or monkey cups. There are larvæ which are only found in the water which collects in the inter-nodes of bamboos.

As a general rule it may be said that anophelines shun water which is highly contaminated with organic matter and water in artificial receptacles. The trees, bottles, etc. which are so often accused of spreading malaria are quite innocent of the charge made against them.

Anophelines choose for their creches uncontaminated natural collections of water. The old Irish lady said "Clean mud is no dirt" and the anophelines agree with her—for contamination by clean clay is not objected to. There are certain anophelines which seek brackish water for their babies—but pure sea water is taboo.

As I have said it is not known why there is this choice—and where the objections lie—for larvæ have been brought to maturity in the laboratory under conditions which are quite foreign to any to which they are subject in nature. Anopheline larvæ are never found in pure sea water and the introduction of sea water into certain swamps in Panama banished the malaria. In the Bombay laboratories, however, larvæ have been brought to maturity in concentrated sea water. Maculatus, the great malaria carrier in Malaya and one of the two chief carriers in Hong Kong, is never found in nature in manure contaminated water—yet in Kuala Lumpur maculatus larvæ were bred out in water to which cow manure had been added until it was grossly polluted.

Range of Action.

With regard to range of action, mosquitoes have been known to fly two miles in search of food, but the limit of range of most species does not exceed a radius of half a mile from their place of

birth. From time to time one notes the invasion of a district by an enormous number of individuals of one species simulating the swarming of bees. It is not known what determines this movement.

Food.

On the question of food one must consider both the larvæ and the adults. The food of the larvæ consists of animalculæ and organic matter floating on or suspended in the water. Anophelines are surface feeders, culicines and stegomyias seek their food at lower planes. In the laboratory one can keep the larvæ alive and bring them to maturity if one places in the water a raison or even a few blades of fresh green grass.

The natural foods of the adult males are fruit juices and fruit pulp, but never blood. The females in addition to fruits and plant juices have a longing for blood. Some species prefer the blood of one animal some that of another. The choice of blood is important in the epidemiology of Malaria—for though in the laboratory all anophelines can be infected with Malaria through being fed on a malarious patient, it by no means follows that all anophelines are malaria carriers. A species which in captivity may take the only blood offered it, may in nature refuse man's blood and prefer that of animals. In the Dutch Indies and in certain parts of the Southern States of America animals, such as buffaloes, cows and pigs, are used as bait to attract mosquitoes and draw them away from man.

With regard to hours of feeding. Most mosquitoes are active at dusk. But there are some like Maculatus which appear to prefer a late supper– say anything from nine to midnight. In the Philippines, where men were used as bait, it was found that Maculatus came late at night and got away before dawn. Very few remain in the house during the day and that is why the attentions of this potent malaria carrier so often escape notice. They come and go like the thief in the night and no one saw their entrance or the exit.

It has been found that blood meals stimulate the development of the mosquitoe's ovaries and thus increase the production of eggs. The female seems to know this by instinct and she craves for blood. The presence of animals thus increases the propagation of mosquitoes, and man by his presence may increase the propagation of malaria carriers and in this way assist in his own destruction.

Light.

It is believed by many that all mosquitoes shun light and that is why they sleep in the day and hunt at night. This is not altogether correct. There are mosquitoes like the Stegomyias which bite freely in the bright sunlight. Most mosquitoes, however, avoid the full glare of the sun—and rest in the shade of bushes, trees, etc. But they

are not necessarily asleep as any one can find out by going to a shaded place beloved of certain species and feeling them bite.

With regard to artificial light—certain kinds of mosquitoes are attracted by them—possibly just in the same way as moths are. The planter in his lonely bungalow knows that the lighting of his lamps is the mosquitoes call to dinner.

Temperature.

Larvæ like fish can live when the surface is covered with ice. With regard to the adult—certain species like tropical temperatures, certain like temperatures which are cooler but none like real cold weather which makes them sluggish and torpid. In the winter the insect hibernates.

The Length of Life of a Mosquito.

The length of life of the adult mosquitoes under natural conditions is unknown—but from the diminution in numbers noticeable after destruction of breeding places the life span of the average mosquito can only be a matter of a few days. There must of course be those which survive from one summer to another having passed through a winter in which there is no breeding. In captivity the majority die within a few days—but some have been kept alive for several weeks.

The Natural Enemies of Mosquitoes.

The natural enemies of adult mosquitoes are spiders, lizards, bats, birds and predaceous insects. They are most certainly subject to diseases caused by microbes and moulds but little is known of this subject. I have seen ticks attached to mosquitoes but I do not know whether or not they do them any harm. Malaria is a disease which causes gross pathological changes in the tissues of the stomach wall of the insect and it would seem that such changes must affect its health. However, this much is certain, that mosquitoes can be full of malaria and yet have their appetites for blood unimpaired.

Wind and rain are detrimental and countless numbers of adults are destroyed with each tropical storm.

The larvæ and pupæ, confined by the limits of the pools they occupy, are even more liable to attack than the adults. Their enemies include beetles, bugs, dragon fly larvæ, batrachians, birds and fish. There are a number of species of small fish which are voracious feeders on larvæ and which will quickly clear a pool or well of all larvæ provided they can get at them. Small fish called millions, natives of the West Indies which are voracious feeders on larvæ have been imported to different countries. In Malaya there are several small fish which are just as good—and it is probable that similar ones exist in Hong Kong.

Factors detrimental to mosquito life other than those due to natural enemies.

As with all life physical, chemical, thermal and biological factors have a bearing on the welfare of mosquitoes.

The eggs can only hatch in the presence of water which is between certain degrees of temperature. If there be no water the germ of life in the egg perishes.

The larvæ are tender naked creatures when born and very susceptible to untoward influences. The older larvæ are more hardy but even they are very delicate creatures. Water which is too acid or too alkaline or which contains poisons in solution will kill them. Some species live in putrid water but most anophelines require for their development water of a high degree of purity and they die in the presence of decaying or fermenting matter.

All larvæ are killed by such larvicides an the disinfectants (cresols, carbolic, mercury salts, copper salts, arsenical salts, formaline, etc.).

The mineral oils such as petroleum and its derivatives have a two fold action on larvæ. They enter the breathing tubes and kill partly by their poisonous action partly by blocking up the tubes and causing suffocation. Vegetable oils kill more slowly by suffocation only. With regard to mineral oils the lighter oils are the more lethal. In order of their efficacy come petrol, kerosine, liquid fuel, crude oil.

With regard to the adult mosquitoes they are detrimentally affected by winds, rains, smokes, certain vapours, and low temperatures. They require water and suitable foods for their vital processes and if these be withheld they die.

Mosquitoes as the vectors of disease.

Mosquitoes play a very important role in the transmission of disease. Malaria, yellow fever and dengue are all spread from man to man through the medium of these insects. In each case the germ undergoes development in the body of the insect and only when the development is complete can it transmit the disease.

It should be carefully noted that though there are innumerable species which attack man very few afford suitable soil for the development of those organisms which are pathogenic to man and therefore very few are of any importance in the spread of disease. So far as we know malaria is only carried by anophelines, yellow fever and dengue by stegomyias. With regard to filaria a few anophelines and a few culicines act as hosts. Up to date 11 out of the 150 species of anophelines, 7 out of the 20 species of stegomyias and one or two of the innumerable species of culicines have been proved to be disease carriers. It is very important that this should be realised for it is of

great economic importance. It is easier to get rid of a few species than it is to get rid of all mosquitoes.

The importance of mosquitoes in the economic development of tropical countries may perhaps best be illustrated by the case of Panama. Had the French been in possession of the knowledge which they and we now possess they would not have failed in their attempt to cut the canal. In the Isthmus during the French occupation the most important of the breeding places of the stegomyias responsible for the spread of the yellow fever were situated in and about the hospital. The hospitals as hospitals were as good as any then existing, what was lacking was knowledge of the epidemiology of the disease. The bedposts of the patients were placed in cups of water to prevent ants from disturbing them. In these cups the stegomyias bred. At night the nurses carefully closed all doors and windows to keep out the swamp air which was then thought to spread the malady, shutting in the real carriers. Outside in the garden were numerous flower pots each standing in a saucer of water the home of countless wrigglers. There in the hospital were all the factors for the spread of the disease and neither the doctors, the nurses nor the patients were aware of the facts.

War Against Mosquitoes a Scientific Problem.

When one understands the extent of the mosquito question one realises that the eradication of disease through mosquito reduction is not so simple as on the surface it appears to be and that there is a probability of time and money being wasted on useless measures if those in charge of the works be not conversant with the habits and life histories of the local varieties. The same argument applies to mosquito reduction for the abatement of nuisance. What is the use of the individual house-holder taking action if his neighbours encourage propagation by leaving tins, bottles, cisterns, gutters, with water in them and allow puddles and pools to remain in the premises. Such action simply invites the lady mosquito to lay her eggs and bring up a family. In other words it invites the creation of a nuisance and possibly the spread of a disease which may result in sickness, invaliding and even death to those in the vicinity. Now people do not court sickness and death by choice, when they do so it is from ignorance, or neglect to put into force what knowledge they have attained. There are those who do what they ought not to do, and there are those who leave undone what they ought to do and the result is often that there is no health in us. To persuade the unbelievers and to force the recalcitrants and to stimulate the lazy it is necessary to have laws. Dr. James, adviser on tropical diseases to the Ministry of Health who has just completed a survey of the mosquito problems in Kenya said in his report:—"No malaria scheme based on measures to reduce mosquitoes has ever been successful which

did not include strict legislation to enforce necessary measures." What he said applies to Hong Kong. It would be simply throwing away money to employ an organisation if the customs and prejudices of the populace and the so called freedom of the individual be allowed to overweigh the comfort and well being of the whole.

War against mosquitoes like war against man is a scientific problem. Individual efforts may effect local successes but for an anti-mosquito campaign of any magnitude to be a success it must be planned by one who has studied the enemy's habits and who is acquainted with his life history. Every effort must be made to bring untoward influences to bear upon the enemy's front line, the adult mosquitoes, and upon his reserve the larvæ. Not only must the general know his work but each individual down to and including the private must be so trained that he will do his duty without a hitch. In an anti-mosquito campaign thoroughness is everything, lack of attention to detail will spoil all. And the campaign must be spread over a sufficient area no attention being paid to artificial boundaries such as those set up by the land office to mark out lots. If this be not done the enemy will concentrate on the borders and by aeroplane night raids continue to do damage, the raiders returning to their reserves and recruiting grounds (breeding places) before morning. One has to do as the enemy does in a campaign and the enemy is no respector of boundaries.

It is essential that one general be in charge of the operations over the whole area concerned. Division of authority and the splitting up of forces trusting that each will co-operate perfectly with the other simply spells failure and is one of the chief reasons why in the early days anti-malarial schemes failed in the Federated Malay States. The General must clear the country of breeding grounds for a radius equal to the average flight range of the enemy. He cannot respect boundaries for the enemy does not. He must have authority to go wherever necessary and to do whatever is necessary to keep the enemy in check. And when the country has been cleared of the enemy the work is not finished.

A force must be left in occupation, a force sufficient to keep the defensive works in order and deal with any new enemy recruiting grounds (breeding places which may arise).

For any preventive campaign the following are necessary :—

(1) Knowledge to know how to act.

(2) Authority to act.

(3) Money to pay for the work.

(4) Staff to do the work.

(5) Statistics and knowledge of local conditions to know when and how to act.

(6) Accurate maps to know where to act.

(7) The willing co-operation of the people.

Every endeavour should be made to gain the good will and co-operation of the people. With their willing co-operation the battle is half won, with their opposition it is almost already lost.

It may interest you to know that there is a certain district in India where a malaria carrying anopheline breeds in the wells—which wells could be kept free of larvæ if only they were kept stocked with small fish. But it is impossible to keep them stocked with small fish as there is in each well a large fish which would eat them all up. The natives will not dispense with the big fish for it acts as an indicator of the quality of water in the well. Once upon a time it was not uncommon for one person to poison his neighbour's wells. If the big fish swam about the water was sound if he floated abdomen upwards it was not. Custom dies hard and the big fish remains, also the malaria.

A NEW CONCEPTION OF THE EPIDEMIOLOGY AND ENDEMIOLOGY OF CHOLERA.

by

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Cholera was attributed by Koch in the year 1882 to the presence in the human intestine of a "comma bacillus" or vibrio possessing certain morphological and cultural characteristics. As man alone amongst animals is subject to cholera, it is impossible to satisfy Koch's own postulates regarding the causal relationship of this vibrio to the disease. Nevertheless the "comma bacillus" or vibrio of Koch is generally accepted as the causal organism of cholera. In addition to the morphological and cultural characteristics of the vibrio as originally described by Koch, later observers added the serological characteristic of "specific agglutinability" and claimed that vibrios not possessing this agglutinability [illegible] "true" cholera vibrios though in every other respect indistinguishable from the vibrio described by Koch.

Further investigations revealed the fact that sporadic cholera a disease indistinguishable clinically from epidemic cholera is very constantly associated with non-agglutinating vibrios which differ from the vibrio of Koch in "agglutinability" alone.

Extended search by many observers in many parts of the world also proved that no chronic carriers of agglutinating vibrios could be demonstrated. nevertheless it was inferred on the analogy of carriers of the bacillus typhosus that such carriers of agglutinating vibrios must exist and that the disease lay dormant in these carriers in the intervals between epidemic outbreaks, in spite of the fact that all attempts to demonstrate such carriers had proved negative. Spontaneous outbreaks of epidemic cholera had also been observed to occur in many places where no history of immediate infection from any outside source could be obtained or be reasonably inferred.

It was also frequently assumed that Bengal was the only endemic home of cholera and that every outbreak of cholera in every other country of the world could theoretically be ultimately traced to its origin in Bengal. Our researches however into cholera in the endemic area of the Asansol Mining Settlement, Bengal, have led us to a new conception of the epidemiology as well as the endemiology of this disease.

In the first place it was observed by us that during the dry hot weather in the Asansol Mining Settlement (March to June) vibrios were very numerous in the ponds or ground tanks much frequented by the inhabitants of the Settlement for washing after defæcation. On washing being prohibited in these tanks under the Regulations for the Prevention and Control of Cholera in the Asansol Mining Settlement it was found that vibrios gradually diminished in number and always disappeared after 12 to 14 days. We therefore concluded that the vibrios found by us in these tanks were derived by pollution of the water with human fæces but when we attempted to isolate vibrios from the stools of those frequenting the tanks our efforts were a complete failure. As there could be no doubt however that the source of the vibrios in the tanks was the human intestine we concluded that the ordinary peptone enrichment process for isolating vibrios from solid stools was unsatisfactory. We therefore set out to discover a method modelled on nature and after much experiment by trial and error devised what we shall refer to as the "open-bowl" method of cultivating vibrios from stools which was fully described in the Indian Medical Gazette of February 1926, page 56. The method briefly is as follows:—

Enamelled bowls of 500 ccs. capacity are used each containing 250 ccs. of 1% salt solution together with a few ccs. of 1% peptone solution.

Each whole stool is first thoroughly emulsified in 400 ccs. of 1% saline solution and allowed to settle for 6 hours in a conical glass. 40 to 50 ccs. of the clear supernatant fluid being then inseminated into one of the enamelled bowls.

For the examination of stools of cholera cases and also as a rule of cholera contacts a different method is used. Small quantities of the cholera stools to be examined are first inseminated by means of dry pieces of wood or twigs from a neighbouring tree into large test tubes (6 ins. x 1 ins.) containing to be 15 ccs. of 1% salt solution. To the salt solution in these test tubes we have found that the addition of peptone is unnecessary, since 1% salt solution is a selective medium in which vibrios temporarily multiply whilst other fæcal organisms are either held in check or die out.

On the arrival of the test tubes in the laboratory, or after 2 to 6 hours at room temperature, about six large loopfuls of the surface liquid in the tubes are inseminated into the bowls described above.

The inoculated bowls in both cases are left in lockers at room temperature, protected from dust and air. A few loopfuls of the surface layer of the bowls are tested daily for the presence or absence of vibrios by intensive methods of cultivation through peptone medium and subsequent plating out on bile-salt agar. (Should vibrios not ap-

pear in the bowls within one week they are considered negative. In positive cases vibrios as a rule appear within two to three days, and when abundant persist in the bowls up to four weeks.

By means of the "open-bowl" method we have been able to prove that in many localities of the endemic area of the Mining Settlement as many as 35% of the inhabitants are chronic carriers of non-agglutinating vibrios.

With regard to clinical cholera we clearly ascertained as mentioned above that two bacteriological types existed—sporadic cholera and epidemic cholera. Sporadic cholera we found in every respect identical with epidemic cholera save only in its apparently non-infectious or feebly infectious character and in the fact that it is associated with "non-agglutinating" vibrios. Mackie & Storer[1] however record an outbreak of clinical cholera in a military hospital in Alexandria which was due to non-agglutinating vibrios. They also cite the case of a human volunteer who developed severe symptoms of clinical cholera after experimental ingestion of non-agglutinating vibrios, and our experimental rabbits after intravenous injection of these vibrios constantly suffered from severe diarrhœa and toxæmia. Epidemic cholera on the other hand is highly infectious and is constantly associated with "agglutinating" vibrios sometimes however of varying degrees of "agglutinability." It is obvious therefore that "agglutinability" in a vibrio is not essential for the causation of the symptom-complex *known as cholera, though the communicability of the disease would seem* to be closely associated with this characteristic.

In our efforts to demonstrate the identity of agglutinating and non-agglutinating vibrios found in cases of clinical cholera we first attempted to convert the non-agglutinating into the agglutinating form by animal experiments but without definite success. Amongst other experiments we made a vaccine of a non-agglutinating vibrio obtained from a case of sporadic cholera and injected it intravenously into a human volunteer having no agglutinin in his blood for Koch's vibrio. The serum of this volunteer was then found to be able partially to agglutinate Koch's vibrio (1-20). We also in one instance injected a non-agglutinating vibrio intravenously into a rabbit which on the death of the rabbit after six days was recovered from its gall-bladder. The vibrio was then found not only to have acquired partial agglutinability but also the capacity to absorb about 80% of the agglutinin from high titre Koch's serum.

These two experiments while proving that the two vibrios are very closely allied serologically were however inconclusive. We therefore decided to abandon the idea of converting the non-agglutinating into the agglutinating form and to attempt the conversion of the agglutinating into the non-agglutinating form instead. For this pur-

pose a fresh cholera stool which was subsequently proved in the laboratory to contain great numbers of agglutinating vibrios was inseminated into a ground tank, the water of which had also been proved to be free of vibrios. Samples of the water of the tank in the vicinity of the inseminated stool were then tested every two hours and it was found that the agglutinating vibrios in the cholera stool permanently changed *en masse* into the non-agglutinating form under natural conditions in the ground tank after 12—14 hours. This experiment we repeated several times with the same result. Laboratory cultures of Koch's vibrio were also similarly tested and were found to change into the non-agglutinating form after 24—36 hours. Agglutinability is therefore mainly an artificial property developed and fixed by laboratory cultivation since laboratory cultures of agglutinating vibrios take approximately three times as long as the vibrios in the stools from which they are derived to lose their agglutinability under natural conditions in ground tanks.

Extended examinations of the stools of epidemic cholera convalescents showed that 80% of these convalescents became chronic carriers of non-agglutinating vibrios, the agglutinating form permanently disappearing from the stools within two to four weeks.

A similar change in serological reaction, or "loss" of agglutinability in the cholera vibrio it may here be remarked was recorded many years ago by Greig[2]. More recently Calalb[3] has described an identical change in the Shiga-Flexner group of B. dysenteriæ in the intestines of survivors of bacillary dysentery. Analogous serological variations are also recorded by Cunningham in the spirochæte of of Relapsing fever[4], by Uhlenhuth & Grossman in the leptospiræ of Weil's disease[5], and by workers in South Africa in the bacillus pestis of Plague[6].

5% of healthy contact carriers of agglutinating vibrios likewise become chronic carriers of non-agglutinating vibrios, the remainder freeing themselves altogether of vibrionic infestation within two to four weeks.

It has also been a matter of common observation in many countries where cholera occurs in epidemic form, that during epidemics (due to agglutinating vibrios) *non*-agglutinating vibrios invariably appear in great numbers in contaminated water supplies (sewers, etc.) the non-agglutinating vibrios disappearing pari-passu with the disappearance of the epidemic.

Vibrios of varying degrees of agglutinability have also been found by us in eleven cases of epidemic cholera, and in two cases we have isolated both non-agglutinating and agglutinating vibrios from the same cholera stool.

On the other hand after examination of thousands of stools we have been unable to discover one permanent carrier of agglutinating vibrios in the Mining Settlement and no such carrier has ever been reported by any other observers elsewhere.

We have therefore been driven to the unavoidable conclusion that the non-agglutinating vibrio (which is itself capable of causing clinical cholera) takes on the agglutinating characteristic under certain bio-chemico-physical conditions in the human intestine the nature of which are at present unknown, and in this mutation form is the cause of epidemic cholera, since it is not unreasonable to assume that a characteristic so unstable may as easily be acquired as lost. Non-agglutinating vibrios therefore in our opinion constitute the reservoir of cholera both epidemic and endemic.

During the cold weather in the Mining Settlement (November-February) vibrios are so scarce as to be practically non-existent in the water of ground tanks commonly used by the inhabitants for the double purpose of bathing and drinking, but with the onset of the hot weather (March) they begin to make their appearance and become very numerous as the hot weather advances. It was observed by us that during hot weather thunder-showers always considerably increased the numbers of vibrios demonstrable in the tanks. In this connection it is of interest to note that small showers during the hot dry weather are popularly credited in those parts of Bengal where cholera is epidemic at that season of the year with the capacity of increasing the intensity of existing cholera epidemics. Chemical analyses of surface washings after these thunder-showers showed that the percentage of salts as well as of organic matter in them is very high. This would reasonably account for the exacerbation of existing epidmics owing to the rapid multiplication of vibrios in infested tanks following the increase of their saline and organic contents. With the establishment of the monsoon, vibrios decrease greatly in numbers and are even found temporarily to disappear when rain falls continuously for one or more days. During breaks in the monsoon however vibrios are always to be found in considerable numbers in ground tanks.

The curve of cholera in the Asansol Mining Setlement was found by us very closely to follow the curve of the vibrionic contents of surface water supplies (ground tanks), the annual epidemic season being confined to the hot weather March to May when vibrios are very numerous, with occasional epidemic outbreaks throughout the rains when vibrois are often present in considerable numbers, followed by a period of almost complete quiescence during the cold dry season when vibrios are extremely scanty or non-existent. It is to be noted that the annual rise and fall of the number of vibrois in ground

tanks although closely related to the epidemic curve of cholera is entirely independent of the actual *existence* of cholera in epidemic form and occurs whether cholera exists or not.

The endemicity of cholera in any locality in our opinion depends primarily upon the existence in the community of great numbers of (healthy) carriers of non-agglutinating vibrios, secondly on the occasional conversion in the intestines of a proportion of these carriers—by some vital process—of the non-agglutinating vibrio into its mutation form the agglutinating vibrio, thirdly upon the widespread and continued pollution of drinking water supplies generally surface water supplies i.e. ground tanks with this mutation form through the unhygienic habits and customs of the people, and fourthly upon the capacity of vibrios to persist or multiply in the drinking water supplies of the locality owing to climatic conditions, a vicious cycle being thus established.

When once therefore cholera has been introduced into a community in widespread epidemic form great numbers of chronic carriers of non-agglutinating vibrios remain apparently for years, amongst whom cholera of the sporadic or the epidemic type may occur at any time, and if owing to the unhygienic habits and customs of the people surface drinking water supplies are habitually contaminated by them, then cholera will become endemic in such a locality provided that the climatic conditions are suitable for the survival and persistence of vibrios in the drinking water supplies.

On the contrary where wholesale pollution of drinking water supplies does not occur, or where conditions are unfavourable to the persistence or multiplication of vibrios in the drinking water supplies cholera cannot become endemic. In these circumstances also epidemic outbreaks if such occur cannot become widespread or sustained in character and will "fizzle out," as they are reported by Col. Gill ordinarily to do in the Punjab during the hot dry weather (I.M.G. January, 1926, Page 1). Cholera therefore in our opinion can only become epidemic in any locality during those periods of the year when owing to climatic conditions vibrios are capable of persisting or multiplying in the drinking water supplies of that locality.

We also venture to predict that in the Deltaic area of Bengal vibrios will be found to persist or multiply in the surface water supplies of that area at the two periods of the year only when cholera is ordinarily epidemic there, one during the hot dry weather immediately before the annual inundation of the country and the other immediately after the inundation has subsided while temperature is still high and before the onset of the cold weather, the flooding of the country during the rains as well as the fall in temperature during the cold weather being both unfavourable to the growth or persistence of vibrios in the surface water supplies there.

On the other hand in the dry and arid regions of North Western India the epidemic season of cholera is confined to the rains, since only during that season is there the necessary amount of surface water as well as the necessary temperature associated with the insanitary habits of the people to make an epidemic of cholera possible.

Where the percentage of chronic carriers of non-agglutinating vibrios remains small spontaneous outbreaks of cholera will be infrequent and in such areas cholera if it occurs at all will be chiefly an imported disease.

We have been unable to ascertain by experiment whether or not the agglutinating vibrio immediately after it has lost agglutinability is still capable of conveying epidemic cholera, but from our combined observations in the field and laboratory we conclude that the vibrio is capable of conveying cholera for sometime after agglutinability has been lost. An additional factor therefore in the spread of epidemic cholera is the period of time which has elapsed between the contamination of drinking water with the agglutinating vibrio and its ingestion as a non-agglutinating vibrio by non-immunes.

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1. Jour. R.A.M.C. August 1918, p. 167.
2. Hewlett Manual of Bacteriology. Ed. VII, p. 336.
3. Trop. Dis. Bull. January 1920, p. 43.
4. Trans. R. S. Trop. Med. & Hyg. Vol. XIX. Nos. 1 and 2, p. 11.
5. Trop. Dis. Bull. August 1926, p. 590.
6. B.M.J. No. 3422, August 7th, 1926, p. 250.

AFFECTIONS OF THE EYE
in
GENERAL PRACTICE.
(continued)

DISEASES OF THE IRIS AND CILIARY BODY.

by
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Reflecting on the various forms of iritis, it is with diffidence that one finally diagnoses a case to be of gonorrhœal or syphilitic origin, but to face the task fearlessly is in the end the better way.

The case I referred to of having diagnosed gonorrhœal iritis in a man whose history showed that infection took place 19 years previously, and upon the examination of whose prostatic fluid the gonococcus was found, illustrates the value of thoroughness; thoroughness not only in the diagnosis of such a condition, but the lack of thoroughness in treating the original infection. Time and again I have had such a diagnosis confirmed, and always in the same way. The gonococcus had been lurking in the prostate gland for years. One case in which the iritis was but moderately severe, in fact the attack was abating, when, as the result of prostatic massage, the inflammation in the eye became excessively severe. The anterior chamber was completely filled with gelatinous exudate and the pain was intense. The pupil was kept widely dilated with atropine. The patient was placed in a nursing home, and had hot fomentations hourly. After several weeks the iritis completely subsided. Not a single synechia was left and the resulting vision was 6/5.

In chronically recurring forms of gonorrhœal iritis a gonorrhœal vaccine, together with prostatic massage will do good. In focal or toxic forms, nearly every dentist one knows has had cases where, upon the extraction of one or more teeth, the patient has had cessation from constant eye trouble. But neither doctor nor dentist can diagnose which teeth are at fault. Dental radiograms must be produced both for the doctor and the dentist to decide which are and which are not healthy teeth.

Again let me illustrate this. A lady who consulted a Harley Street dentist and another in Edinburgh, was declared to have a healthy set of teeth. While travelling abroad, she suffered from an attack of iritis in one eye. I insisted upon dental radiograms being

taken. At first she refused, but I was supported by her general practitioner. As the result of X-raying her teeth, it was found that the roots of no less than fifteen teeth were infected. She spent three months getting these removed. This occurred several years ago, but since then she has not had a single attack of iritis. Dental radiograms should be the rule, not the exception, both with doctors and dentists.

With regard to syphilitic forms of iritis, the diagnosis from the history of the case is not always easy. Many of these patients firmly believe they never contracted syphilis. Others, even to their doctors, attempt to hide the fact.

One case I had where the patient at first denied that he had contracted this disease, but he was suffering from one of the worst forms of pseudo-tumour of the orbit or gummatous cellulitis that I have ever seen. As I found his Wassermann reaction was strongly positive I again questioned him and discovered that four years previously his doctor told him that a small wart which had appeared on the penis was not a chancre. In reality it was an aberrant form of chancre such as was so often seen among the troops in France.

If the iritis has appeared in a case which had suffered several years previously from interstitial keratitis, the scars of which can be seen in the cornea, the Wassermann reaction may be or may not be positive. I have said in a previous article that in acquired syphilis the Wassermann reaction can indicate the result of treatment, but in congenital cases it is the clinical manifestations which must be observed as the measure of thorough treatment. Therefore in a case of iritis due to acquired syphilis, the Wassermann reaction will be the best guide.

Another example will show how one can infer from a patient's own statement what is the probable cause of the disease. A patient aged 46 discovered that the sight of one eye was becoming slightly dim. When the eye was examined, it showed not the slightest sign of inflammation, but a faint nebulous haze was spreading across the cornea. The patient unwittingly volunteered the information that her father had locomotor ataxia, and without stating my diagnosis except to the patient's doctor, I prescribed Mist. Hydrarg. c. Iod., with the happy result that not a trace of opacity was left in two months' time.

The action of atropine in iritis is as follows. First it keeps the iris and ciliary body at rest. It diminishes the hyperæmia and prevents the formation of posterior synechiæ, or breaks down those already formed. Atropine ointment 1 per cent. should be used thrice daily. The use of 2 per cent. atropine ointment in best left to the ophthalmic surgeon.

Some patients cannot bear atropine. One may see the eyelids, after a few applications of the ointment, swollen, the conjunctiva chemosed, the skin swollen down to the angle of the mouth, the appearance closely resembling that of erysipelas. All that it is necessary to do, if this happens in any particular case, is to substitute ½ per cent. hyoscine ointment for the atropine, and smear the skin surface with zinc ointment.

Passing from iritis, we briefly take up the study of cyclitis. The ciliary processes, about 70 in number, are disposed radially from near the root of the iris. The term uveitis is used on the Continent to indicate an inflammation of the iris and ciliary body. It is not a good term to use although it will illustrate the frequency with which inflammation involves the tract as a whole. It is probable that iritis never occurs without some cyclitis and vice versa.

Clinically, we say cyclitis is present when we find keratitic deposits have formed on the posterior surface of the cornea. They are commonly referred to as "K.P." and are looked upon with anything but a favourable eye. These deposits are exudates from the ciliary body passing through the pupil into the anterior chamber. They may organise and completely close the pupillary margin of the iris. They may organise and form membranous opacities in the vitreous, and sometimes a cyclitic membrane. These may finally form bands which usually cause detachment of the retina. The intra-ocular tension becomes lowered and the eye is quite soft to the touch, the end result being a shrunken globe, (phthisis bulbæ).

Fortunately all cases of cyclitis do not end thus. If the cause of a cyclitis be a toxin from a septic focus, and that septic focus can be discovered, such as a suppurating antrum of an ethmoidal sinus, then a cure may be effected, although relapses are frequent. Sepsis in the pelvic organs of women will cause a cyclitis later becoming a chronic irido-cyclitis.

I can recall a case in which I discovered the presence of a diseased uterus. There had been a purulent vaginal discharge for four years together with a contemporaneous history of irido-cyclitis in both eyes for three years. When I first saw the patient, the left eye was completely blind, and the right eye, although not blind, was in a state of inflammation. The operation of hysterectomy produced a most favourable result. The inflammation began to subside before the patient left hospital, and now for five years, during which time a cataract was removed, the patient has been able to attend to the wants of her family.

How can one recognise K.P.? If a beam of light is thrown on the cornea by means of a magnifying glass, minute white dots are seen scattered over the posterior surface of the cornea in a characteristic

Reference to the illustration No. 1 will indicate the situation of the canal of Schlemm, which is close to the root of the iris and if it is imagined that the space between the lens and the back of the cornea is lessened, then the iris will be carried forward also and the angle at the root of the iris, close to the canal of Schlemm, will become obliterated. The canal of Schlemm itself may be almost obliterated so that cessation of filtration at this angle may take place.

Reference again to the illustration No. 2 will show that the most likely part of the eyeball to give way is the entrance of the optic nerve through the lamina cribrosa. The surface of the nerve head becomes concave, and as the pressure within the eyeball rises, so that concavity is increased. The pressure will cause the fibres of the optic nerve to atrophy so that blind spots may be found within the field of vision. A glaucomatous cup differs from a physiological cup by its exceedingly sharp overhanging walls. The vessels are seen to dip suddenly into this hollow and may disappear behind the overhanging edge to reappear again passing to and from the eye. Where the vessels bend over the edge of the optic cup the pulsation of the veins and arteries may be noticed. The raised intra-ocular pressure causes degeneration of the nerve fibre layer of the retina. The choroid becomes thinned. The patient often complains of severe pain, usually of sudden onset. Coloured haloes are seen around lights. A candle, for instance, may be seen distinctly by one eye, and with the other appear misty and with coloured haloes around the flame.

The onset of glaucoma may be so sudden that the patient really has not time to notice these coloured haloes, for vision has diminished to counting fingers or merely seeing hand movements, and the pain may be so severe that the patient is quite sick. One patient suffering from acute glaucoma told me she thought the trouble was more with her stomach than with her eyes. The pain was intense, radiating all over the head. Sleep was impossible, and yet, as soon as the intra-ocular tension was reduced by trephining, the pain disappeared and the sickness at once passed away. The average case of acute glaucoma fortunately is not quite so severe. The pupil is seen to be slightly dilated and immobile as the ciliary nerves passing through the choroid from the posterior of the eye suffer from pressure. Diminution of vision is due to cloudiness of the media, poor intra-ocular circulation and pressure on the retina. The epithelium on the surface of the cornea becomes œdematous so that the pupil is not readily seen. But it is remarkable how quickly on reducing the intra-ocular tension, the cornea becomes quite clear.

In cases of subacute glaucoma the tension varies greatly. The patient sometimes sees coloured rings due to increased tension on the cornea. At other times the rainbow lights are not seen. It is remarkable that worry and anxiety will increase the tension of such an

escapes to Schlemm's canal, it is obvious that the tension of the eye must rise.

If there is a complete blockage, then an acute attack of glaucoma is produced; if it is not complete, then a subacute attack is caused. In this latter, the eye may not even be red, although in acute glaucoma, it is frequently most difficult to diagnose the condition from an acute iritis.

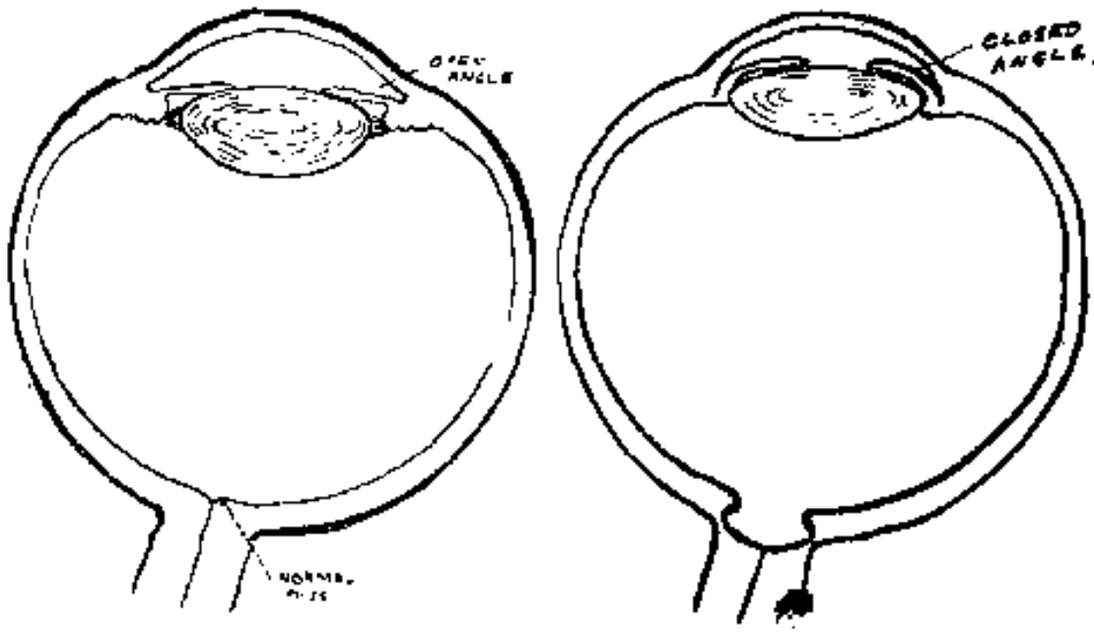
Primary glaucoma usually occurs after 50 years of age. It is remarkable that sometimes it is hereditary, occurring at an earlier age in each succeeding generation.

Myopic eyes, being somewhat larger than hypermetropic eyes, are therefore, from an anatomical standpoint, less liable to the onset of this disease. In hypermetropic eyes with small cornea, glaucoma is very likely to supervene sooner or later.

As age advances, the anterior chamber of the eye becomes smaller, so that the combination of the following anatomical states, a small cornea, a shallow anterior chamber, and a gradually enlarging lens, tends to produce the condition known as glaucoma.

As the patient grows older, sclerosis of the various tissues takes place, that of the eye not escaping, so that the ligamentum pectinatum may become thickened. Very occasionally just as syphilis can produce sclerosis of arteries and veins, so the region of the pectinatum may become sclerosed.

One case of what I presumed to be idiopathic glaucoma, and in which the sight was rapidly diminishing, I trephined. But as the wound healed the patient developed typical interstitial keratitis, and it was only then I discovered a strong Wassermann reaction to be present. But such a case is comparatively rare.



form, that of a triangle with the apex opposite the pupil and the base across the lowest part of the cornea. If the disease has subsided, the small dots will have become brown. The keratitic deposits consist of leucocytes deposited from the aqueous.

If the irido-cyclitis is due to defective teeth, the removal of such may be followed by a cure. Singularly enough one of the most successful cases I had was that of a dentist's wife who promptly had her diseased teeth removed. The K.P. quickly disappeared and vision returned to normal and has remained so for several years.

If the cause is syphilis the case is anything but a favourable one. Plastic exudates are everywhere and the vitreous becomes completely clouded. I have not seen a single case of recovery although it should not be said that such a case, if recognised early, could not be cured.

Again let me remind my readers that the iris should be kept dilated by means of atropine. In cyclitis as in iritis, hot bathings or the constant use of a Japanese muff warmer, are of the greatest help.

Regarding medicines, salicylates do good in some cases. Small doses of calomel are of use, but the general practitioner should always have the guidance, if possible, of an ophthalmic surgeon in these serious cases.

GLAUCOMA.

Glaucoma is a disease of the eye which, sooner or later, is seen by every general practitioner. Many a doctor regrets that he has not learnt to feel the tension of an eye while in the ophthalmic wards at hospital.

Glaucoma is that state of the eye in which damage is done by increasing intra-ocular tension. The exit of the normal circulating fluid remains the same or may be increased.

It is a disease of adult life. It is most frequently associated with hypermetropia, and is rather uncommon in myopia.

Primary glaucoma is produced by the pressure of the lens which gradually increases in size during life. The peripheral border of the lens approximates closely to the ciliary body. If the lens and the ciliary body come into contact, the circulation of the aqueous fluid is interrupted. The effect, according to Priestley Smith, will be to prevent the fluid which is secreted by the ciliary body from passing forwards through the pupil. The lens will, therefore, be forced forwards, and will push the iris in front of it making the anterior chamber very shallow and bringing the periphery of the iris into contact with the corneo-sclera. In this manner, what is known as the filtration angle, (that is the angle between the root of the iris and the corneo-scleral junction), will be blotted out. As it is from this angle, through the fibres of the ligamentum pectinatum that the aqueous

eye. The colour that is imparted to the pupil by the œdematous corneal epithelium gives it a bluish green tint, hence the term "glaucoma," the Greek equivalent for "sea green."

Between the attacks in subacute glaucoma, the field of vision is found to be gradually decreasing. Frequently, the period during which the intra-ocular tension of the eye increases, is prolonged. Gradually the eye becomes harder. Coloured rings may or may not be seen. The field of vision very gradually narrows, and if the size of the blind spot is reproduced, say by Bishop Harman's scotometer, it is found to be enlarged beyond the normal. It is in such cases that an acute attack may suddenly supervene.

In women, venous congestion associated with menstruation, worry, an illness or the worry consequent on such an illness, seems to be the exciting cause, and it is in such a condition also, that if the eye is slightly reddened, the diagnosis of iritis may be made and atropine instilled. In chronic glaucoma, which is insidious in onset, with periodic attacks of slight neuralgic pain, and occasional coloured haloes around lights in the evening, if atropine is instilled, a real attack of acute glaucoma may be precipitated.

The appearance of an eye suffering from acute glaucoma strongly resembles an eye suffering from acute iritis. If it is iritis and atropine is withheld sight may be lost through extensive posterior synechiæ being formed. If it is glaucoma the application of atropine but intensifies the disease. When one realizes that glaucoma may destroy vision in 24 hours, it is incumbent that a correct diagnosis be made. The corneal microscope has come to our aid. If the pupillary margin can be seen at all in glaucoma, there is no newly formed pigment present and therefore no synechiæ. Further in glaucoma, the œdematous epithelium is first noticed, whereas in iritis, the aqueous in the anterior chamber is seen to be full of fine exudates while the cornea itself still remains clear.

To help the doctor to diagnose between glaucoma and iritis, I will place the symptoms of each disease side by side as follows.

IRITIS.	GLAUCOMA.
May occur at any age, often in young and middle aged people.	Usually the patient is beyond the age of 50 years.
One eye is affected, with a history of gradual or sudden onset without prodromal symptoms.	Both eyes usually show some symptoms. There is a history of prodromes in 75 per cent. and the onset is remarkably sudden.
Cornea is clear but aqueous humour may be cloudy.	Cornea is steamy. Sensitiveness is reduced, and aqueous clear.
Anterior chamber usually deep.	Anterior chamber shallow.
Pupil usually contracted.	Pupil slightly dilated and may be oval shaped.

Iris is a muddy colour.
Pigment or posterior synechiæ often present, or pigment deposits on the lens.
Reaction of the pupil sluggish.
Deep circum-corneal injection.
Tension normal or slightly soft. Rarely raised.
Neuralgic pain both in eye and around orbit.
Attack may last for weeks, but if pupil is kept dilated by means of atropine, sight may not be at all impaired.

Iris, if seen, is clear.
Deposits and synechiæ absent.
Reaction often absent. The whole eye is injected uniformly.
Tension raised so that eyeball feels quite hard and cannot be dimpled with the finger tips.
Pain severe, radiating all over the head. Often accompanied by sickness.
If atropine is instilled, it usually means destruction of vision.

May I give the following illustration. A lady aged 56, suffering from acute glaucoma in one eye, and who stated she had had several attacks previously, but not so painful nor blinding as the present one, was seen by me and found to be suffering intense pain, and gastric disturbance. The eye was quite red all over. The cornea was so hazy that the pupil was seen with difficulty. This was at 4 p.m. She proceeded at once to a nursing home where a drop of 1 per cent. eserine and hot fomentations were applied hourly. A strong purgative was also given. By 10 o'clock the pain had lessened considerably. The sickness had disappeared. The cornea had become quite clear, and the somewhat immobile pupil reduced in size by the action of the eserine. The following morning, the patient was quite comfortable, and vision was once again clear. What should be done? I kept the patient in bed for four more days when the eye had become much quieter. Remembering that the patient had sustained several attacks previously, each becoming worse than its predecessor, I trephined the eye which rapidly became its normal colour, and full vision together with practically full field remained. There is now no fear of a further attack of acute glaucoma.

A word regarding secondary glaucoma. Glaucoma in this instance follows upon some other disease. If the pupillary margin of an iris shows complete posterior synechiæ (occlusio pupillæ), the result of an attack of iritis, the aqueous cannot escape through the pupil to the anterior chamber, iris bombé is produced, and unless the iris is perforated either by passing a fine graefe knife through and through or performing an iridectomy, the tension of the eye will rise.

If the capsule of the lens is left in a corneal wound after excision for cataract extraction, secondary glaucoma may follow.

Traumatism of the lens producing swelling of the latter, raises the tension of the eye.

Dislocation of the lens may produce secondary glaucoma, and it must never be forgotten that one of the symptoms of intra-ocular tumour may be raised tension also. These are among the chief causes of secondary glaucoma.

A question that is sometimes asked of the ophthalmic surgeon is can eserine cure chronic glaucoma? Although the use of eserine or pilocarpine will reduce the tension of glaucomatous eye, they never cure chronic glaucoma. It may be necessary to use either of these myopics for weeks or months, but if the field of vision is found to be decreasing, only good can come from an immediate trephining operation.

Readers of this article will readily see that trephining rather than performing an iridectomy is my operation of choice, and as the result of doing a considerable number of trephining operations, I have not the slightest cause to regret having made this choice.

GAS LEAKS FROM DOMESTIC REFRIGERATORS.

by

Norman H. Chamarette.

Several gaseous substances of a more or less toxic nature have come into current use due to the recent industrial stride along the road of mechanical methods of refrigeration.

For several years ammonia was almost the only refrigerant employed by the manufacturers. Recently other refrigerants have been introduced of which sulphur dioxide and methyl chloride are the most important and in commonest use. All refrigerating systems depend on the repeated gasification and condensation of the refrigerant used. Those mostly used are,

(1) Methyl chloride.

(2) Ethyl chloride.

(3) Sulphur dioxide.

(4) Ammonia.

In most cases the refrigerant is confined under pressure, hence its escape from the smallest fracture in the system is very likely.

So rapid has been the growth of the industry concerned in the manufacture and disposal of these refrigerants, that there has been insufficient opportunity to acquire a knowledge of the likely hazards to health involved.

During the year 1928 twenty-five cases of poisoning, with seven deaths, by commercial methyl chloride gas have been reported in Chicago. Twenty-two of these twenty-five cases occurred in kitchenette apartments where gas-leaks were discovered in the electric refrigerating system. The other three cases developed in a factory where methyl chloride refrigerators are manufactured. In most of these reported cases, a gradual onset of two days or more with drowsiness and confusion is outstanding, passing on to coma, vomiting, pain in abdomen and marked mental confusion. In the more severe cases the restlessness, confusion, weakness and nausea, later abdominal pain, pass on to convulsions and cyanosis alternating with coma. In some instances the patients were aroused from their coma by attacks of vomiting. Delirium was noticed in not a few cases. Headache persists, and the temperature is variable. The urine gave positive tests for di-acetic acid, formic acid and acetone. The blood picture was that of a primary anæmia.

The peculiar musty, sweetish odour of the breath when the case s first seen and the odour of acetone about the patient, also showing he above suggestive symptoms, suggest possible recent exposure to

methyl chloride, and should be investigated. On account of the metal symptoms several of these cases were referred to psychiatrists. Undoubtedly they have to be differentiated from encephalitis lethargica, botulism and cerebral hæmorrhage.

The success of treatment depends upon early recognition of the causitive factor, immediate removal of the patient from further exposure and rapid means of elimination. The progressive symptoms in the severe cases are said to be due to cerebral necrosis.

It is easy to imagine the reaction of the general public when this danger is made known. Laymen are not expected to know that all refrigerating devices do not use the same refrigerant, hence they conclude all such devices are dangerous.

Electrical refrigeration which has already gone so far along the lines of preventing food spoilage and enhancing public health, and has won ready acceptance as a household convenience, will have a tremendous setback which will take many years of selling effort to counteract. Hence convincing precautions on the part of the manufacturers is expedient.

Putting a ban on methyl chloride is not the solution to the problem except as a last resort. In the first instance, improvement in design and installation with periodical inspection is desirable. Methyl chloride is less toxic than other refrigerants, and is free from odour or irritating effects, it would not awaken a sleeping person. Possibly methyl chloride could be impregared with a substance which would impart a distinctive odour or produce an irritation in the respiratory passages, or stimulate sneezing so as to serve as an alarm of leaks. The high volatility of all practicable refrigerants makes it quite improbable that enough of these substances could be absorbed, and retained in the food-stuffs stored in the refrigerators to be really harmful.

The Commissioner of Health at Chicago has drafted an ordinance regulating the construction and installation, which it is hoped will aid in protecting the public from further risks.

CHINESE MATERNITY HOSPITAL, KUALA LUMPUR.

Medical Officer's Report for the year 1929.

M. Y. Lum, M.B., B.S.

ADMISSION.—During the year under review 3,018 patients were admitted into the Hospital as compared with 2,801 in 1928 and 2,168 in 1927, thus making an increase of 217 and 850 cases respectively.

Of the babies born in the Hospital 1,560 were males and 1,467 females.

The birth of twins occurred on 18 occasions.

The patients were drawn from the following places in the numbers indicated:—

Kuala Lumpur including Pudu, Pantai and Sentul	1,259
Sungei Besi	262
Ampang	190
Cheras	149
Kajang	139
Salak	126
Kepong	83
Sctapak	83
Broga	78
Serdang	74
Kanching	65
Batang Bina and Bangi	65
Semenyih and Sungei Lalang	58
Rawang	52
Seremban	46
Sepang	34
Rasa	33
Ulu Klang	32
Batu Arang	21
Ulu Langat	20
Kuala Kubu	18
Klang	18
Serendah	16
Kalumpang	16
Ulu Yam	15
Tanjong Malim	12
Kuala Pilah and Bahau	9
Sungei Way	6
Bentong	5
Kuala Selangor	5
Raub	5

Singapore...	4
Malacca	4
Taiping	3
Johore	3
Ipoh	2
Penang	2
Teluk Anson	1
Gemas	1
Siam	1

DEATHS.—There were only 6 maternal deaths, making a death rate of less than 2 per mille.

The causes of death were 2 ante partum hæmorrhage before admission, 2 puerperal septicæmia, 1 heart disease and 1 eclampsia.

Considering the absence of ante-natal clinics in the country and the great number of cases of albuminuria and heart disease admitted for confinement the results so obtained are excellent.

There were 86 babies still born and 15 premature still births. Twenty babies died shortly after birth many being premature.

INSTRUMENTAL DELIVERY.—There were 60 cases which required instrumental deliery.

ABNORMAL PRESENTATIONS.—	Breech	42
	Foot	39
	Placenta Prævia	10
	Transverse	8
	Cord	6
	Face	4

RESIDENT STAFF.—The staff consisted of a Matron, two Assistant Matrons and 12 Probationers. They worked very hard and great credit is due to them.

There were 332 confinements attended by the Matron and Assistant Matrons outside the Hospital, thus making the total number of cases attended by the Hospital Staff amount to 3,350.

Eight probationers presented themselves for the local Government Midwifery Examination and all passed.

SUPERVISION.—Dr. D. C. Macaskill, the Honorary Visiting Medical Officer, visited the Hospital occasionally during the first part of the year and went away on leave in June.

At least two visits per day were paid by me to the Hospital during the year.

GENERAL.—The Chinese Maternity Hospital, Kuala Lumpur, has become one of the largest maternity hospitals in the world, and Kuala Lumpur may well be proud of it.

In spite of the additional new ward and the number of beds been increased to 70, the Hospital was always overcrowded. Should the patients come in in mathematical regularity, the Hospital could only accommodate 2,520 cases per annum, allowing for each case to remain in Hospital for the maximum period of ten days. This figure, of course, excludes those ever present women (20-30 in number) waiting for confinement. The number of patients will continue to grow, and with a view to relieve "hypercongestion" I beg to recommend to the Committee to induce Seremban philanthropists to build their own Chinese Maternity Hospital as Klang has done.

At the beginning of the year there were only two paying wards. These were found insufficient, and the number was increased to five. They were well patronised and the amount collected by the Association as fees was $2,797.50, a gratifying sum.

Clinical Notes.

GUMMA OF THE INNER END OF THE CLAVICLE.

by

Alexander Cannon, M.D.

Our patient is a Chinese male aged 40 years (English calculation) and the diagnosis lay between tuberculosis on the one hand and syphilis on the other. To make certain of our diagnosis it was essential to deal with this particular case in this order: (1) look at the condition (here we can do this by carefully examining the six photographs in turn); (2) family history; (3) personal history; (4) physical signs, and laboratory findings; and then (5) discussion of these observations; (6) diagnosis; and then (7) treatment. The *photographs* show the swelling of the inner end of the clavicle, and by comparing the lesion with the tapemeasure, the size can be accurately calculated. The series of plates vividly portray the rapidity, under treatment, with which the lesion disappeared.

The *Family History*.—The father and older brother both died of tuberculosis . . . . . "they used to vomit a lot of blood." The patient (No. 9513) states that a Chinese doctor once told him that he was suffering from tuberculosis. Ten years ago he married, and a few months ago became a widower . . . (cause of wife's death not ascertained). Two children were born, one ten years ago, and died at the age of three years (English calculation) of (?) scurvy; and the other son is now alive and well at the age of four years.

Personal History.—History of syphilis ten years ago; the lesion was only treated locally for a left inguinal bubo which developed later. Says that he occasionally vomits a little dark red blood (this may be from the dilated œsophageal veins and not from the lungs: about a teaspoonful or at most a dessertspoonful of blood). He had symptoms of cirrhosis of the liver (which may actually be due to gumma).

The swelling of the inner end of the clavicle was first noticed about nine months ago, and a fortnight earlier the pain had commenced. When the swelling was first noticed, the patient complained of sudden pain going "down the left arm," which was worse when he tried to use or move the arm. The nature of the pain was boring in character, and was much worse at night, and as the swelling increased so did the pain, until by the time he first saw us, he was in agony.

For some months previous, three Chinese doctors, and then two European doctors, treated him without result. He was also treated at one of the local hospitals, but was given up as a hopeless case.

The patient stated to an disinterested observer that "since the 'blood injections' my swelling has disappeared, and so has the pain,

Gumma of the Inner End of the Left Clavicle cured by Autohaemotherapy in 73 days.
(30 injections)

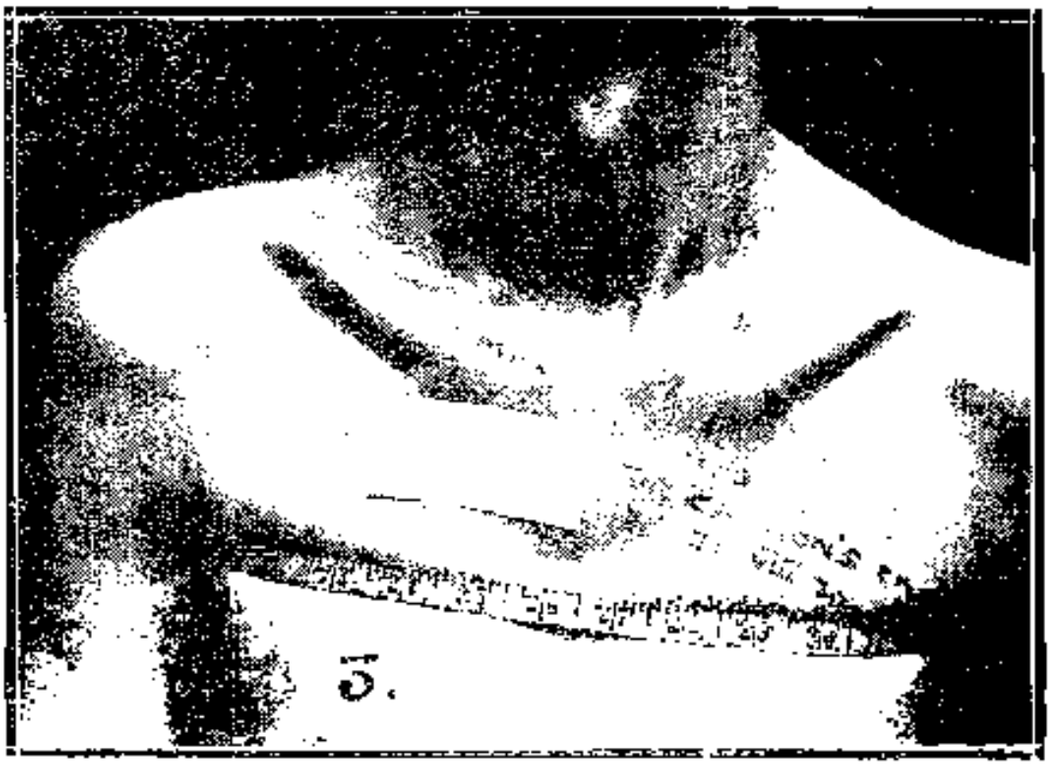
[illegible]

Admitted to hospital for "severe" pain in left arm. Unable to move the limb. Cannot sleep at night owing to pain.

(Visiting cards used throughout of standard size 3″ × 1½″ for purpose of measurement.)

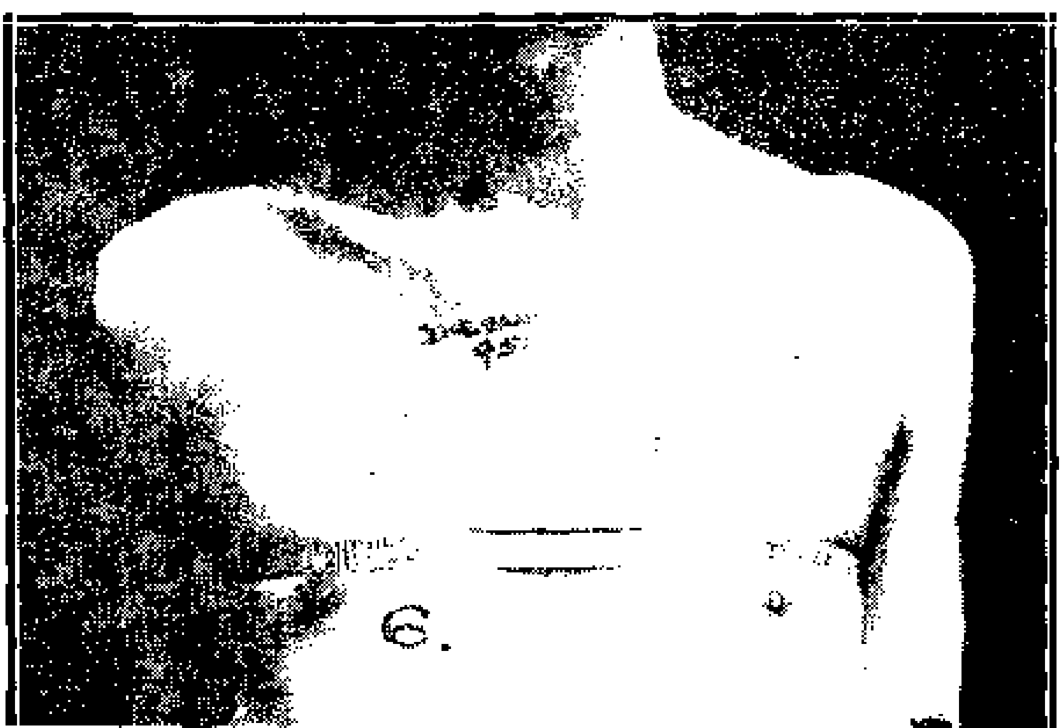
[illegible]

No pain. Movement without pain, but limited.


5.

[illegible]

[illegible] without pain



[illegible] CURED.

States he feels better than he has done for many years

[illegible]

Over two months after cure. Working hard without any pain. No recurrence.

and my arm is made well again; my cough which used to trouble me at night no longer does so." "I have not vomited blood for some time now."

Physical Signs.—The tumour fluctuated in the centre, and when first seen measured two and a half inches in line with the clavicle and two inches at right angles to that line. A rough estimate of its protrusion above the normal surface level was one and a half inches, at least. How deep it was can be judged from the symptoms produced by its pressure on the brachial plexus and subclavian vessels. No more pain produced by pressure. There was no discolouration of skin. Slight tenderness to touch on outer borders. No local joint symptoms. The temperature was not raised.

Laboratory Signs.—We thank Dr. Minett and Dr. Laing for kindly carrying out the Wassermann reaction on several occasions. The W.R., was strongly positive, and remained so for two weeks after which it has remained negative to date.

The sputum was examined and "T.B. detected."

There were not (nor are there now) any other signs of tuberculosis, but it is nevertheless possible that the two conditions are present (a much more frequent combination than is often realized). No sugar in the urine. Sp. Grav 1013: normal to the usual tests.

Discussion.—Is this swelling tuberculous or syphilitic or anything else?

Of the thirty-three conditions mentioned by Leftwich, we can with certainty confine ourselves in this case to these two conditions.

Let us first consider the swelling itself.

In *syphilis* we find that in tertiary periosteal forms the pain is worse at night, and especially when the parts are kept warm. The swelling may be either diffuse or localized. There is never any discolouration of the skin (unless due to applications to the part), and there may be tenderness on pressure. If osteomyelitis is present there is diffuse sclerosis of ivory density which can be distinctly made out. Then there is intolerable aching (owing to the tension in the bone). When *gumma formation* occurs, fluctuation is usually evident, and there is often severe pain especially at night, and pressure symptoms may occur and be very alarming.

Considering *tuberculosis* we must remember in the epiphyses, that caseation and necrosis, may occur; and osteomyelitis or *chronic abscess* supervene. The pain is in proportion to the depth of the lesion, and subjection to pressure. The swelling may be of the bone itself, of the soft parts covering the bone, or purely an abscess. If an abscess, there is a bluish tinge of the skin over that part, and if T.B., it is "cold" (no inflammatory phenomena). It may track to

a great distance in deep bone lesions. Fever is usually absent before the abscess breaks or becomes infected. There are joint symptoms either of deformity, immobility, and/or pain.

It will be seen that there is evidence here in favour of both T.B., abscess and gumma, but the vote is undoubtedly in favour of gumma. A careful consideration of the patient's history, and close application of signs and symptoms in favour or against either side should leave no doubt in the readers mind.

A timely word might here be spoken regarding the Wassermann reaction, lest it might have tended to bias the diagnosis in spite of the T.B. found in the sputum. It must not be forgotten that a Wassermann reaction may be positive in the following conditions (alphabetically arranged): aneurysm, diabetes, disseminated sclerosis, 50% cases of chronic eye disease, G.P.I., leprosy, cancer or cirrhosis of the liver, locomotor ataxy or tabes dorsalis (6%), malaria, noma, osteitis deformans, pellagra, Raynaud's disease, SYPHILIS—congenital 100%, primary 30% only, secondary 100%, tertiary 75%, meningitis 75%, ... trypanosomiasis, and yaws. Nevertheless, *a strongly positive W.R., always indicates syphilitic infection* (If the patent has been taking mercury, bismuth, or arsenic preparations, a three weeks course of Iodide is necessary before the test is made). It is interesting to note that a person with a strong positive W.R., is immune to the cobra venom reaction (normally haemolysis occurs, but not in syphilis, or cancer). A further word might not be spoken in vain regarding the *Porges-Meier Reaction*. This gives the same results as the Wassermann reaction, but the advantage is that every clinician can carry out the test in his own consulting room, or even in the patients own home. A 1% emulsion of lecithin in normal saline is mixed with an equal part of blood serum, and allowed to stand at room temperature for five hours. The lecithin is precipitated by syphilitic but not by normal serum. I have had the opportunity of checking the results given by this test by those done by my colleague Dr. Mineti at the Bacteriological Institute, and found the results to be parallel and reliable. A word of warning must be sounded the lecithin preparation must be prepared by the chemist *fresh*, every day. The method is well known and used on the Continent of Europe.

The *diagnosis* Gumma of the inner end of the left clavicle.

Treatment.—Auto-haemo-therapy. The technique was described in the August Number of the "*Caduceus*," under "The Cunning Ways of Syphilis." This patient received thirty-six injections given every other day, the time occupied in the treatment being seventy-three days.

Remarks.—The dates on which the seven photographs shown were taken are July 22nd, August 9th, August 20th, September 7th, September 17th, October 3rd and December 7th, 1929. The patient has now been discharged two months and is doing hard labour in H.M. Prison, Hong Kong.

The Wassermann reaction is now negative and no T.B. were detected on the last occasion in the sputum.

The patient has gained five pounds in weight. (120 lbs., on July 22nd, 122 lbs., on August 1st, and 125 lbs., on November 15th, 1929). No other treatment has been given and no diet beyond that usually given in hospital.

This is a case of gumma of the inner end of the clavicle which has been cured both clinically and so far as laboratory tests are concerned; and may be—also the T.B. Are we not told in Leviticus. Ch. XVII, 11 . . . . . " For the life of the flesh is in the blood " (as is frequently the death of the flesh, through the blood in the form of toxin poisoning, and later septicæmia).

Review of Books.

"*The Essentials of Histology*": Edited by Sir Edward Sharpey-Schafer, F.R.S. Professor of Physiology and Histology in the University of Edinburgh, with the co-operation of H. M. Carleton, PH.D. Lecturer on Histology in the University of Oxford. Twelfth Edition. Published by Messrs. Longmans, Green & Co., Ltd., Price 15/- net.

To review such a book as this in detail is by no means an easy task; the new edition is so thorough in its treatment and so exact in its matter that it has not only lived up to, but even enhanced the reputation of previous editions and one is almost tempted to suggest that the book has gone beyond the stage of "Essentials."

The early chapters are well worth recommending to the special attention of students, general cell structure, the histology of the blood cells,—including the Arneth count—being well set out. It is this elementary cytology, the real basis of the subject, that the student generally skips over rapidly in his endeavour to get on to the "real part of the subject."

To those of us situated away from the large seats of learning and from intimate contact with our fellow scientists, the appendix is a most valuable part of the book, for in it all the standard methods of staining and section cutting are dealt with in a method which brings the technical side right up to date.

The efficient treatment of such a subject as Histology demands a large number of diagrams and figures, and this necessity is well met. It is doubtful however whether the photographs reach such a high stardard.

On the whole the Editor and his collaborator are to be congratulated on producing a volume which should enable the student to get the maximum value out of his observations in the laboratory.

"*The Internal Secretions of the Ovary*": By A. S. Parkes, M.A., PHD., D.SC., (Monographs on Physiology Series), London. Messrs. Longmans, Green & Co., Ltd., 1929. Pp. 242. Price 21/- net.

Nowadays medical science is making remarkable advances in almost innumerable directions; long since, it has been impossible for one man to keep pace with all these advances, and now it has become a life's work to keep pace with the progress in one direction. This is nowhere better exemplified than in the realm of the ductless glands.

One great disadvantage of such rapid strides is that the medical man has not time to read all the current literature on the subject in which he is specially interested, and if he waits until time has established the truth of any new work he is then already out of date. This difficulty is shared also by the teacher who has to decide when new work is sufficiently established to incorporate it in a medical syllabus.

It is for these reasons that a work such as the latest of the Monograph Series is invaluable. Dr. Parkes has not only studied his subject but he has also been a prolific worker at it as well, and his book must rank as a standard work on ovarian secretions.

The book seems to establish definitely the rôle of the anterior pituitary body in originating the œstrus cycle and the connection between this phenomenon and menstruation is of vast importance to the medical practioner.

The book is well printed on good paper and well bound, and contains 65 excellent figures by way of illustration. A very lengthy and complete bibliography containing 661 references makes the book a necessity in any up to date library or research laboratory.

"*The Essentials of Chemical Physiology*": By W. D. Halliburton, M.D., LL.D., F.R.S., J. A. Hewitt, PH.D., D.SC., and W. Robson, PH.D., D.SC.. Twelfth Edition. Pp. xii + 383 . 56 figures, 1 in colour. Messrs. Longmans, Green & Co., Ltd., Price 9/- net.

With the new edition of this well known book comes the inevitable addition of new names on the title-page, and one must agree that the senior author has chosen well in his collaborators for the fact that they are engaged in active teaching is evident from the slight additions and alterations.

The heavy-type practical instructions at the beginning of each lesson is followed by concise explanatory paragraphs, illustrated by structural formulæ and diagrams. A very reliable scheme for the detection of substance of physiological importance is prefaced by a wise warning against merely memorising such a scheme and following it according to rule-of-thumb methods. One wonders how often such good advice is heeded!

This concise and adequate book for medical physiology students is completed by a thorough index running into 24 pages.

Acknowledgments.

We beg to acknowledge with many thanks the receipt of the following contemporaries:—

The Peiping Union Medical Hospital. 21st Annual Report.

The New York Academy of Medicine.

The Journal of Bone and Joint Surgery.

The Japanese Journal of Experimental Medicine.

The Medical Journal of Australia.

The Japan Medical World.

The Journal of the British Medical Association; Ceylon Branch.

The Moukden Medical College Journal.

Dr. Huang's Medical Journal.

The Birmingham Medical Review.

The University College Hospital Magazine.

The St. Mary's Hospital Gazette.

The St. Bartholomew's Hospital Journal.

The Hospital.

The Hospital Gazette.

El Salvador Medico.

La Universidad.

Okayama-Ingakkai-Zasshi.

Chinesische Zeitschrift fur Die Gesamte Medizin.

Monthly Epidemiological Report. League of Nations.