

Report to the Government of British Honduras upon the outbreak of yellow fever in that colony in 1905, together with an account of the distribution of the *Stegomyia fasciata* in Belize, and the measures necessary to stamp out or prevent the recurrence of yellow fever / by Rubert Boyce.

Contributors

Boyce, Rubert W. Sir, 1864-1911.
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Publication/Creation

London : Waterlow, 1906.

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Report

TO THE

GOVERNMENT OF BRITISH HONDURAS

UPON THE

OUTBREAK OF YELLOW FEVER

IN THAT COLONY IN 1905,

TOGETHER

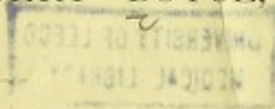
*WITH AN ACCOUNT OF THE DISTRIBUTION OF THE
STEGOMYIA FASCIATA IN BELIZE,*

AND THE

MEASURES NECESSARY TO STAMP OUT OR PREVENT
THE RECURRENCE OF YELLOW FEVER.

BY

RUBERT BOYCE, M.B., F.R.S.



PRINTED BY

WATERLOW AND SONS LIMITED, LONDON WALL, LONDON.

1906.

602628

THE UNIVERSITY OF LIVERPOOL,

February, 1906.

SIR,

I have the honour to submit for communication to the Government of British Honduras the following Report upon the outbreak of Yellow fever in Belize in 1905.

The Report is founded upon my personal observations in Belize, Corosal, Stann Creek, and Punta Gorda, from September 17th, 1905, to the end of the month of October; upon my visit to Payo-Obispo in Yucatan, Livingston and Puerto Barrios in Guatemala and Puerto Cortes in Spanish Honduras, and finally upon my experience of the prophylactic measures adopted in New Orleans during the severe epidemic of Yellow fever in 1905.

I have arranged the Report under twelve sections, as follows:—

1. The account of the Yellow fever outbreak in Belize in 1905, together with references to previous outbreaks, and some of the causes to which they were attributed.

2. Description of the prophylactic measures which are necessary to prevent the recurrence of Yellow fever.

3. Description of the distribution of the *Stegomyia fasciata* in Belize.

4. Description of the water receptacles of the town of Belize. Their relationship to the breeding of the *Stegomyia*, and the necessity of new water and screening Ordinances.

5. Description of the general sanitation of the town of Belize, including drainage, canalisation, refuse disposal, &c. Necessity for filling in "submerged lots," for Building Bye-laws and for certain changes in Sanitary administration.

6. Upon the prevalence of Malaria in British Honduras and its relationship to inefficient drainage. Necessity for prophylactic measures.

7. Description of Corosal, Stann Creek and Punta Gorda, and their liability to infection, and the prophylactic measures which should be taken.

8. Review of the distribution of Yellow fever in 1905 in Mexico and in the Central American Republics, with special reference to the Fruit Ports within five days' reach of Belize.

9. The relationship of trade development to the spread of Yellow fever.

10. Revision of quarantine administration in British Honduras, and the necessity of improvements in (1) early notification, (2) medical equipment and inspection, (3) quarantine accommodation, and (4) quarantine regulations.

11. Account of the recommendations of the most recent Quarantine Conventions, viz., the Pan-American of 1905, and the West Indian Inter-colonial of 1904. The findings of both compared.

12. Note upon the state of sanitary control in Mexico and in the Central American Republics, and the advantage of united anti-Yellow fever legislation throughout America.

In treating the report in this manner, it is hoped that the measures described and advocated therein may be of use not only to British Honduras, but to other colonies in the Yellow fever zone where Yellow fever is present, or liable to occur.

I have the honour to be,

Sir,

Your obedient Servant,

RUBERT BOYCE.

To THE RT. HON. THE SECRETARY OF STATE
FOR THE COLONIES.

ACKNOWLEDGMENTS.

I DESIRE to express my sincere thanks in the first instance to the Hon. P. C. Cork, C.M.G., the officer administering the Government when I arrived in British Honduras, and to the Hon. W. Collet, C.M.G., who, just previous to my leaving the Colony, assumed charge; to Mr. Burchell, the Superintendent of Public Works; to Dr. Harrison, Dr. Eyles, the Colonial Surgeon, Drs. Heusner, Crann, and Davies; to the Hon. H. B. Walcott, President of the Quarantine Board; to the Hon. H. E. W. Grant; to Mr. Biddle and Mr. Baber.

Owing to the hearty co-operation of these gentlemen in every detail, and to the time which they personally gave to furthering my investigations, I was enabled to accomplish far more in the short time at my disposal than I could otherwise have done. Drs. Harrison and Heusner especially willingly gave a large portion of their time to assist Mr. Burchell and myself in the detailed examination of the water receptacles of Belize. I also desire to thank the Assistant Colonial Surgeons, Drs. Gann and Clements, Dr. Gahne, Mr. H. F. Phillips, Sir Walter Lewis, and the leading merchants in Belize for much assistance. The United Fruit Company, both through their agent, Mr. Keith, in Belize, and their Manager in New Orleans, greatly facilitated my visit to the coast towns.

To the President of the State Board of Louisiana, Dr. Souchon, and to Dr. Patton, I am indebted for permission to travel during the period of the fever in Central America.

To Surgeon-General Wyman at Washington, and to Dr. White in charge of the Yellow Fever Campaign in New Orleans, I am deeply indebted for much friendly assistance.



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CONTENTS.

	PAGE
CHAPTER I.—THE YELLOW FEVER EPIDEMIC IN BELIZE—	
High death rate in Yellow fever outbreaks amongst new arrivals in Belize ...	1
No special quarter of the town selected in the epidemic	1
The injurious effects of old views of causes of Yellow fever upon sanitary reform and trade	1
The unfounded prejudices against undertaking excavations or dredging in certain months	2
Some previous outbreaks of Yellow fever in Belize	2
The 1905 epidemic. The officially reported cases do not represent the total number of cases	3
List of cases	5
CHAPTER II.—PROPHYLACTIC MEASURES AGAINST YELLOW FEVER—	
Results of the labours of the various Yellow fever investigators and their effect upon prophylaxis	13
Classification of prophylactic measures	13
(a.) In connection with patient and infected mosquito	13
(b.) Eradication of the <i>Stegomyia</i>	14
Importance of early notification	14
Concealment of cases—penalties	17
Provision for isolation hospital	17
Isolation by screening patient—methods	18
Sealing and fumigating, methods, fumigating materials, &c.	19
Fumigation of adjacent houses and general fumigation	20
Methods of eradication of the <i>Stegomyia</i>	21
The screening Ordinance of New Orleans, 1905	22
Precautions to be adopted in future in harbour and wharf extension ...	23
The use of oil and its disadvantages	23
Mosquito nets and screening houses	24
Anti-mosquito propaganda	24
CHAPTER III.—MOSQUITO SURVEY OF THE TOWN OF BELIZE—	
Examination of water receptacles	25
Total number of lots examined	26
The barrels, kerosene tins, wooden vats, iron tanks and wells	26
Species of larvæ present in the water receptacles, and the relative frequency of the presence of the <i>Stegomyia</i> in the various yards	27
Examination of gutters and pools	28
Examination of crab holes	28
Summary of the mosquito distribution in Belize	28
Relationship of the <i>Stegomyia</i> distribution to the cases of Yellow fever ...	29
CHAPTER IV.—WATER SUPPLY OF THE TOWN OF BELIZE—	
Rain water source of supply	30
Description of receptacles—	
(a.) Vats	30
(b.) Tanks	30

CHAPTER IV.—WATER SUPPLY OF THE TOWN OF BELIZE—*continued.*

	PAGE.
(c.) Wells	30
(d.) Barrels	31
(e.) Oil tins	31
(f.) Odd receptacles	31
Water legislation, Sections of 39—47, Ordinance No. 29, 1894, Belize ...	32
Joint survey of water receptacles with Mr. Burchell and emergency recommendations	33
Resolutions adopted October 2, 1905, for the basis of water legislation ...	34
Cistern stored rain-water compared with other water supplies ...	36
The necessity of a controlled and protected water supply ...	37

CHAPTER V.—GENERAL SANITATION OF THE TOWN OF BELIZE—

The relationship of drainage to the health of the community	38
The uselessness of the shallow drains	38
Depressed and water-logged areas and submerged lots	39
The concrete and brick drains	39
Deep ditches	39
The canals	39
Method of reclamation and filling in	40
Sewage and night soil disposal	40
Refuse disposal	41
Clearing of bush in swamps and town lots	42
Building regulations	42
Height of buildings above ground	44
Provision for wash houses	44
Sanitary administration of Belize. Central and district Boards	45
Recommendations.—1. Necessity of a well trained Sanitary Surveyor or Engineer as an officer of the District Board	46
Sanitation of the Colony.—Relative importance to the Colony of local hospitals and of general colonial sanitary measures	47

CHAPTER VI.—THE PREVALENCE OF MALARIA IN BELIZE AND IN OTHER DISTRICTS OF BRITISH HONDURAS—

Malaria the chief cause of sickness and mortality in British Honduras ...	49
Rainfall table	49
Tables of mortality and sickness returns from Malaria... ..	50
Prevalence of Malaria in 1904	52
Distribution of Anopheles in Belize	52
Prophylaxis and segregation	53
Suggested improvements	53

CHAPTER VII.—REPORT UPON THE THREE PRINCIPAL COAST TOWNS OTHER THAN BELIZE—

Relationship of Corosal to the Mexican side	54
Present state of Corosal and means of dealing with a Yellow fever epidemic ...	55
Consejo and Payo-Obispo	55
Punta Gorda.—Relationship to Guatemala and Spanish Honduras	56
Stann Creek... ..	57

CHAPTER VIII.—YELLOW FEVER IN MEXICO AND IN THE CENTRAL AMERICAN REPUBLICS WITH SPECIAL REFERENCE TO THE FRUIT PORTS—

General trade development	58
Yellow fever in Mexico	59

	PAGE
Progreso, Payo-Obispo, Xcalak	61
Guatemala, Livingston, Puerto Barrios, Santa Thomas, Zacapa, Gualan ...	61
Yellow fever in Guatemala, 1905... ..	62
Spanish Honduras, Puerto Cortes, San Pedro, Rio Blanco, Chamilicon, Choloma, &c.	64
Yellow fever in Spanish Honduras, 1905	65
Nicaragua, Bluefields, Greytown, &c.	66
Yellow fever in interior of Nicaragua	67
Costa Rica, Port Limon	67
Panama, Bocas del Toro, Colon and Panama	67
Yellow fever in the Isthmus	68
Tables showing Ports in which Yellow fever was present in 1905, and within 5 days' sail or steam of Belize	69

CHAPTER IX.—THE SHIPPING TRADE OF BELIZE AND THE RELATIONSHIP
OF TRADE ROUTES TO THE DISTRIBUTION OF YELLOW
FEVER—

Transference of mosquitoes by ships	71
Transference of mosquitoes by baggage	72
Transference of Yellow fever cases by the Fruit and other vessels trading with Gulf and Fruit ports	72
Sea trade of Belize with the United States and Central American Republics	73
Note on the shipping relationships with Mobile, Livingston, Puerto Barrios, Puerto Cortes, Colon, Vera Cruz, Progreso, &c.	76
Transference of Yellow fever by railway	78
The Inter-oceanic Canal and the distribution of Yellow fever	79

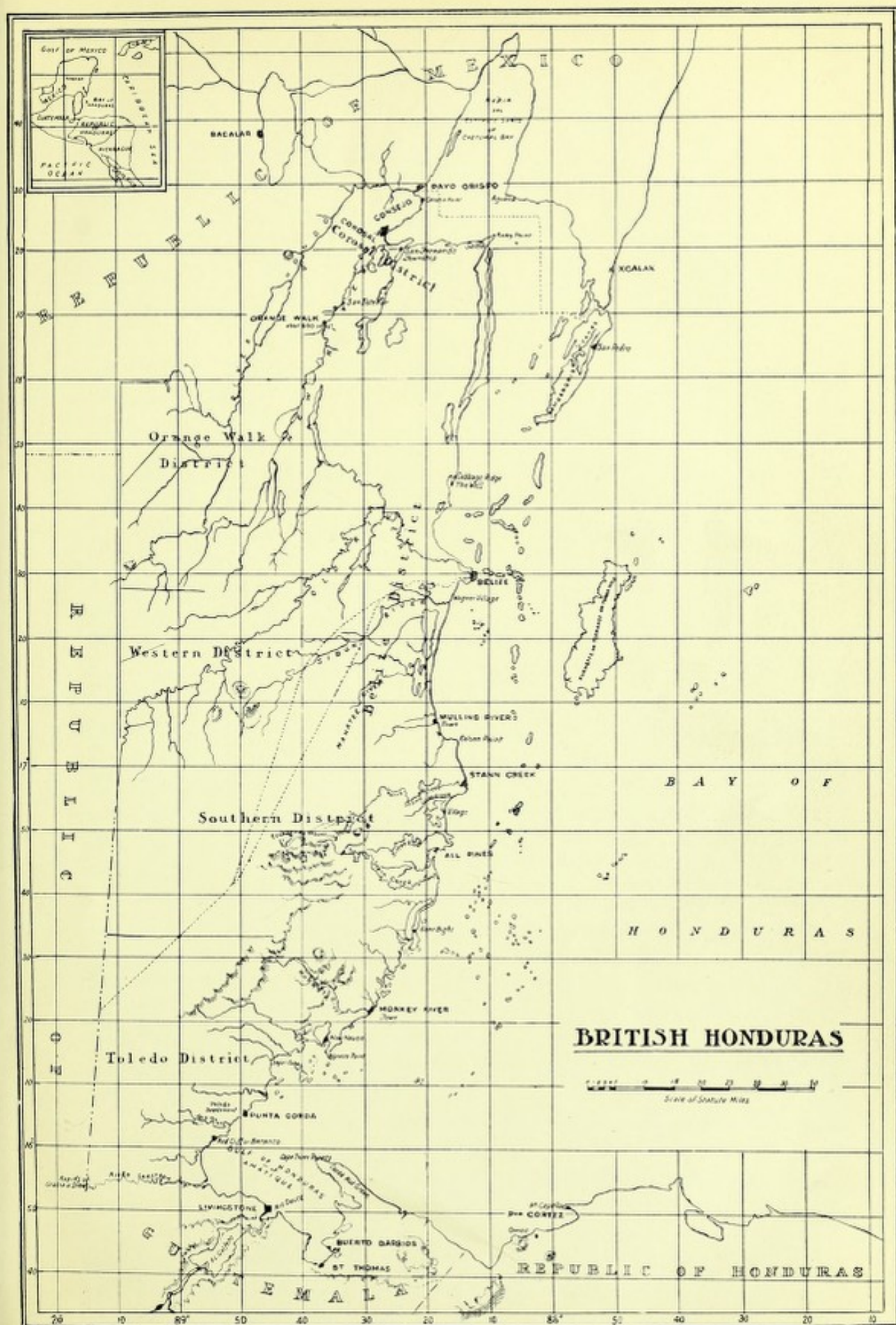
CHAPTER X.—QUARANTINE ADMINISTRATION IN BRITISH HONDURAS—

Basis of quarantine administration	80
Recommendations	82
Early notification of quarantinable diseases	82
Bills of Health	83
Health returns of Foreign Countries	83
Improvements in medical equipment and in inspection at the Ports of entry into the Colony	83
Medical inspection at Corosal, Stann Creek and Punta Gorda	84
Issuing of Bills of Health from additional ports in the Colony	85
Improvements in quarantine accommodation	85
Provision for the isolation and care of quarantinable diseases ..	86
Alterations in the quarantine regulations to bring them up to date...	87

CHAPTER XI.—FEDERAL AND STATE QUARANTINE IN THE UNITED STATES;
INTERNATIONAL SANITATION OF THE PAN-AMERICAN
REPUBLICS, 1905, AND THE WEST INDIAN INTER-
COLONIAL SANITARY CONVENTION, 1904—

Federal and State Quarantine in the United States	89
The medical officers of the United States Public Health and Marine Hospital Service in Belize and in other Foreign Ports	91
International Sanitation amongst the Pan-American Republics	92
The findings of the 2nd General International Sanitary Convention of the Pan-American Republics, Washington, October, 1905	93
The West Indian Inter-Colonial Sanitary Convention, 1904	97
Comparison between the findings of the two Conventions	100

NOTE.—Sanitary Control in Mexico and the Central American Republics ... 103



CHAPTER I

THE YELLOW FEVER EPIDEMIC IN BELIZE. 1905.

PREVIOUS EPIDEMICS OF YELLOW FEVER IN BELIZE AND
THE CAUSES TO WHICH THEY WERE ASCRIBED.

TAKING into consideration the position of Belize in the Yellow Fever Zone and its proximity to Mexico on the one side and Guatemala, Honduras and Panama on the other, neither the numbers nor the severity of the outbreaks appear very great. On the other hand, the numerical strength of the Colony is small and there was never much opportunity for the collection of a large non-immune population; indeed, it is reasonable to suppose that the population largely consisted of immunes. But the mortality, as one would also expect, amongst the few newly-arrived Europeans, appears to have been comparatively very great. The cases have not been limited to any particular season, they have often been distributed uniformly throughout the year, and the longest interval between any two cases has been recorded as 45 days. As one might infer from the smallness of the town, the disease has occurred in a scattered form; there does not appear from the evidence available to have been any one special quarter in which it arose and from whence it spread to other parts.

Looking back upon the views which have been held from time to time to account for these epidemics is perhaps the most useful part of any enquiry into the past history of Yellow fever, for it enables one to appreciate the difficulties which are met with to-day in displacing the older ideas, however irrational they may be, and in substituting the modern views. Such a study also shows the severe injury which was done to material and to commerce, and the needless expense which resulted from these theories at times when the community was least able to bear them.

Yellow fever has been attributed to droughts and to floods, to the "pestilential mangrove swamp," to high temperatures, to fœcal matters, to combinations of atmospheric circumstances, to stone ballast, hundreds of tons of which have been disinfected or thrown into the sea, to excavations and dredgings. These theories have raised bitter controversies, and they have been the cause during epidemics of the loss of much valuable time. Even to-day there exists in many parts a very deep-rooted prejudice against excavations and dredgings during certain seasons, notably in the summer months,

and works of this nature in spite of the fact of their importance and urgency in preserving the health of the community are deferred for an old tradition, and that, too, after Havana has proved the absurdity of it. It demonstrates, however, that the newer facts are not yet fully accepted by a large section of the Public, and that those measures against yellow fever which have now been proved to be the only ones of avail against that disease are not fully adopted. It is hardly necessary to add that in consequence valuable time is lost, and lives and commerce sacrificed.

When it is remembered that the *Stegomyia fasciata* is present throughout the year, and that in consequence a town in the tropics in the Yellow Fever Zone may be as liable to infection in the autumn as in the summer, or in the spring; it is obvious that if the excavated or dredged material contained some poison which inoculated the *Stegomyia* or infected man, it would be as effective in the autumn as in the summer or spring, and dredging or excavations would be equally harmful at any time of the year; it would be impossible to say, as has been done, when "digging operations might be safely commenced." But there is no scientific evidence whatever to show that dredged or excavated material is infective, and the prejudice does not appear to me to be shared by the natives. Dredging operations have been blamed as the cause of the outbreak in Belize, but the fact is lost sight of that at the same time the fever had declared itself in the surrounding Republics, and that dredging has been carried on over and over again without any epidemic occurring. I lay stress on this clinging to past beliefs because I am convinced that a great deal of harm is done even at the present time, and that the necessity for active preventive measures is unfortunately not fully realised.

Without a clear and precise knowledge of the method of transmission it is impossible for any authority to effectively prevent or check a disease like yellow fever, in which scientific precision, thoroughness and immediate action are essential.

The following is a list of the outbreaks of yellow fever in Belize since 1886, taken from the Colonial Surgeon's reports and hospital returns :—

1886.—Epidemic preceded by severe increase of malaria in 1885.

No.	Name.	Date.	Residence Lot No.
1	Margaret Miller...	14th August ...	130
2	Francisco Garcia ...	18th " ...	823
3	Francisco Cuellar ...	31st " ...	11
4	Franz Werner ...	4th September ...	844
5	Carl Weber ...	4th " ...	1,157
6	Maximiano Trejo ...	7th " ...	764
7	William Hynes ...	8th " ...	837
8	Lucy Muschamp ...	9th " ...	196
9	Georgina Machaca ...	? ...	11
10	Vicente Bidinotti ...	10th " ...	1,133
11	Henry Davidson ...	15th " ...	343
12	Giuseppe Bidinotti ...	16th " ...	1,133
13	John Millar ...	17th " ...	65
14	Edward Heath ...	17th " ...	154
15	Charles Wade ...	? ...	69
16	Elesandro Soliz ...	22nd " ...	?
17	Ramon España ...	4th October ...	64

1887.—Sixteen cases occurred in this year.

1888 and 1889.—No cases are recorded. "At the end of 1889 exceptional floods were followed by a severe outburst of malarial fevers, and it has been contended that some of the cases that were then returned as malarial fever were, in reality, cases of yellow fever."—(Colonial Surgeon's Report, 1891.)

1890.—

No.	Name.	Date.	Residence Lot No.
1	Mrs. Jenkins	11th January	130
2	Mr. MacIntyre	20th "	756
3	Mr. Stewart	2nd February	929
4	Mr. Slorach	12th "	929
5	Mr. Butt	10th March	927
6	Mr. Niven	27th "	466
7	Paul Wilson	11th April	807
8	Mr. Watson	26th May	756
9	Thos. Mead	26th June	?
10	John Jones	9th August	85
11	Mary Abercrombie	20th "	33
12	Appolonia Rodriguez	23rd "	445
13	Bruner	25th "	927
14	Elsingburg	15th September	?
15	D. R. McKinnon	24th "	929
16	Sister Theresa	16th October	780
17	Camille de Mezerville	18th November	936
18	Alex. Grant	25th "	1,066
19	Rev. Fr. Hopkins	17th December	997

The cases are scattered throughout the year with intervals of 10 to 40 days. The medical officer regarded this epidemic as an heritage of the 1886-1887 epidemic, the contamination having continued over.

1891.—Six cases of yellow fever were returned in the Hospital Report, of which 3 died.

During the period from 1886 to 1891 there can be little doubt that yellow fever had gained a strong hold upon Belize and had become endemic at that period. It also would have resulted in the creation of a very large immune population, and to the presence of a very considerable number of immunes in Belize at the present time must be attributed in a large measure the comparative smallness of the number of cases in Belize, for there can be no doubt, from the station in life of those who did succumb, that there must have been a very general *Stegomyia* infection throughout the town.

The year 1892 is marked, according to the Hospital Report, by a very large number of malarial cases.

From 1891 to 1905 there is no evidence that Belize was infected.

THE EPIDEMIC OF 1905.

It seems impossible to trace with certainty the first cases of yellow fever this year (1905), whether at Belize, New Orleans, Livingstone or Puerto Cortes. It is very clear that in Belize, as well as in New Orleans and other places, the early cases were not recognised, and that in consequence the disease had gained a firm hold of the town before the danger was realised.

In order, therefore, that the experience of Belize during 1905 may be of value in teaching the absolute necessity of constant vigilance, I have endeavoured to analyse the sickness returns from January to September in order to bring together all suspicious cases. From examination of the case books and other memoranda which the local practitioners were good enough to place before me, it is clear in the first place that there was a considerable amount of malaria, and a slight outbreak of influenza between January and May, 1905.

The Malarial Cases.—I have pointed out in Chapter VI., when dealing with the prevalence of malaria in British Honduras, that this disease was abnormally prevalent in 1904, not only in Belize, but also in Corosal and Orange Walk; further that the type of the disease was very severe, that there was one fatal case of blackwater, that the disease assumed an intense epidemic form in certain localities, and that it went under the name "Railway Fever" on the Puerto Barrios Railroad. In 1905, however, the deaths from malaria do not appear to be abnormal.

In January, 1905, two deaths occurred from remittent malaria in subjects aged 22 and 45 respectively, and one death from intermittent malaria in a baby of 1½ months; in February one remittent case in a man of 37; in March one remittent case in a woman of 32, and in April two remittent cases, one in a man of 70, the other in a man of 30. On May 14th, the death occurred of Miss Bills from what was registered at the time as "bilious fever and hæmatemesis," but which there is now no doubt was Yellow fever. Later, in May, and in June, July and August, further deaths occurred from what was chiefly described as malignant malaria, or remittent malaria; some of these there is now reason to believe, as will be shown further on, were caused by Yellow fever.

In the practice of the local medical men there were, of course, numerous cases of malaria as in other years; there appears to me, however, to be no doubt that in January, May, and April the number of "fever" cases were abnormally high. I am also informed by Dr. White, of the Public Health and Marine Hospital Service of the United States, who had charge of the Yellow fever prophylactic measures in New Orleans, that the same marked increase of what was returned as "malaria" was noted previous to the official declaration of Yellow fever. It is most probable that some of these cases were Yellow fever.

With regard to the symptoms which the cases of malaria presented in Belize, I have been furnished with the following details. Many were cases of persistent fever, lasting from ten to twenty days, refractory to treatment—quinine without effect, fever intermittent, temperature 100–103°, pulse slow, 60–80, urine high coloured and containing bile, bowels constipated. Or again, "the majority of cases dating from the end of 1904 and commencement of 1905 were complicated with jaundiced scleræ, occasional slow pulse and high temperature. The discolouration of the scleræ was slight, however, and passed off in a day or two. In the severer forms "bilious vomiting was recorded." From what I have myself observed this year, and from the description of cases in former years where disputes have arisen over mistaken diagnosis, I am of opinion that it is often very difficult to distinguish between yellow fever and certain types of malaria, in which there may be present a very slow pulse, jaundice, vomiting, bleeding from the gums, delirium, retention of urine, traces of albumin, constipation, and where quinine does not have any marked effect. In autopsies upon these cases I have noted in one instance intense congestion of the gastric mucous membrane, precisely as in Yellow fever. Nor does the finding of the malarial parasites in the blood by any means settle the diagnosis in districts in which malaria is common; instances were recorded this summer in New Orleans in which obvious cases of

Yellow fever presented the malarial parasites in the blood, and we know that malaria does not protect from Yellow fever. Unquestionably, the post-mortem is the most reliable method of arriving at a correct diagnosis, and no stone should be left unturned to obtain an autopsy in any suspicious case. It is also very clear that in countries liable to yellow fever a close watch must be kept upon a rise in the mortality from "malaria," especially in months when such a rise is unusual.

The Influenza Cases.—Commencing towards the end of April and lasting to the middle of May, there was a short three weeks' epidemic of a disease which was regarded as influenza, and which presented the following symptoms:—The onset of the disease was sharp, but did not last long, the patient going to work on the fourth or fifth day. All the members of a family might be attacked, one after the other, and both fresh arrivals and old residents were equally affected, as also the white and black population. There were no fatal cases. The symptoms consisted of a severe headache, temperature 104° to 105° , rapid and extreme prostration, vomiting not as a rule present. Nothing definite with regard to the pulse is recorded. The complications were those of the respiratory tract, coryza, laryngitis and bronchitis. Major B., who died of Yellow fever on June 4th, had an attack of what was regarded as influenza on May 15th, his son having been previously attacked at the end of April. The opinion held by the medical profession in Belize is that there was a short epidemic of genuine influenza; but on the other hand there is evidence to show that in certain cases the disease might well have been Yellow fever.

Apart from the malarial and influenza cases I did not find in the Registrar's returns, deaths from any other cause which might reasonably be viewed with suspicion.

The following is a grouping in chronological order of all cases which, upon re-investigation in the light of the experience of the epidemic, might now be regarded as extremely suspicious, or as genuine cases of Yellow fever, together with the cases which were returned at the time as Yellow fever.

EARLIEST SUSPICIOUS CASES.

Middle of January.—Mr. J. J. F., occupying a house in Gabourel Lane was ill with fever in January, about the middle of the month. He had very slight jaundice and nausea, *i.e.*, his scleræ were jaundiced, but there was nothing special regarding the pulse. His little daughter followed in about a fortnight, but beyond being a persistent fever it had no special features. At this time February 11, Mr. J. W. C. was ill.

February 11.—J. W. C., aged 32, recent arrival in Belize, but been on the East Coast of Africa for many years. English. History is interesting. States that for the past week he has noticed his urine very dark, more like blood, and scanty, had intended to see Doctor, but postponed matters. Felt he had a chill during the night and woke up feeling miserable; however in the morning he went to work, but felt very miserable, and thought he ought to see a medical man. Seen at 2 p.m., temperature 103.6 , pulse 72. Eyes congested and scleræ jaundiced. No tenderness over epigastrium, but feels tender more to right side, and a heavy feeling as if of a weight radiating from right side to centre of abdomen. Gums are clean. Tongue is but slightly furred, breath is foul.

Urine dark, bile coloured and cloudy. Albumin, a trace. Tenderness over spleen, headache, great thirst. Had a fair night, felt so much better that he got up and dressed himself. Urine

still dark, quantity had increased. Albumin, nil. Sclerae deeply jaundiced. Bowels opened. Stools of a dark ashy hue, bad odour, typical of catarrhal jaundice.

February 13.—Patient feels better; only complains of head being heavy and sleeplessness. Fever is down. Urine has cleared up. No albumin. Sp. g. 1.022.

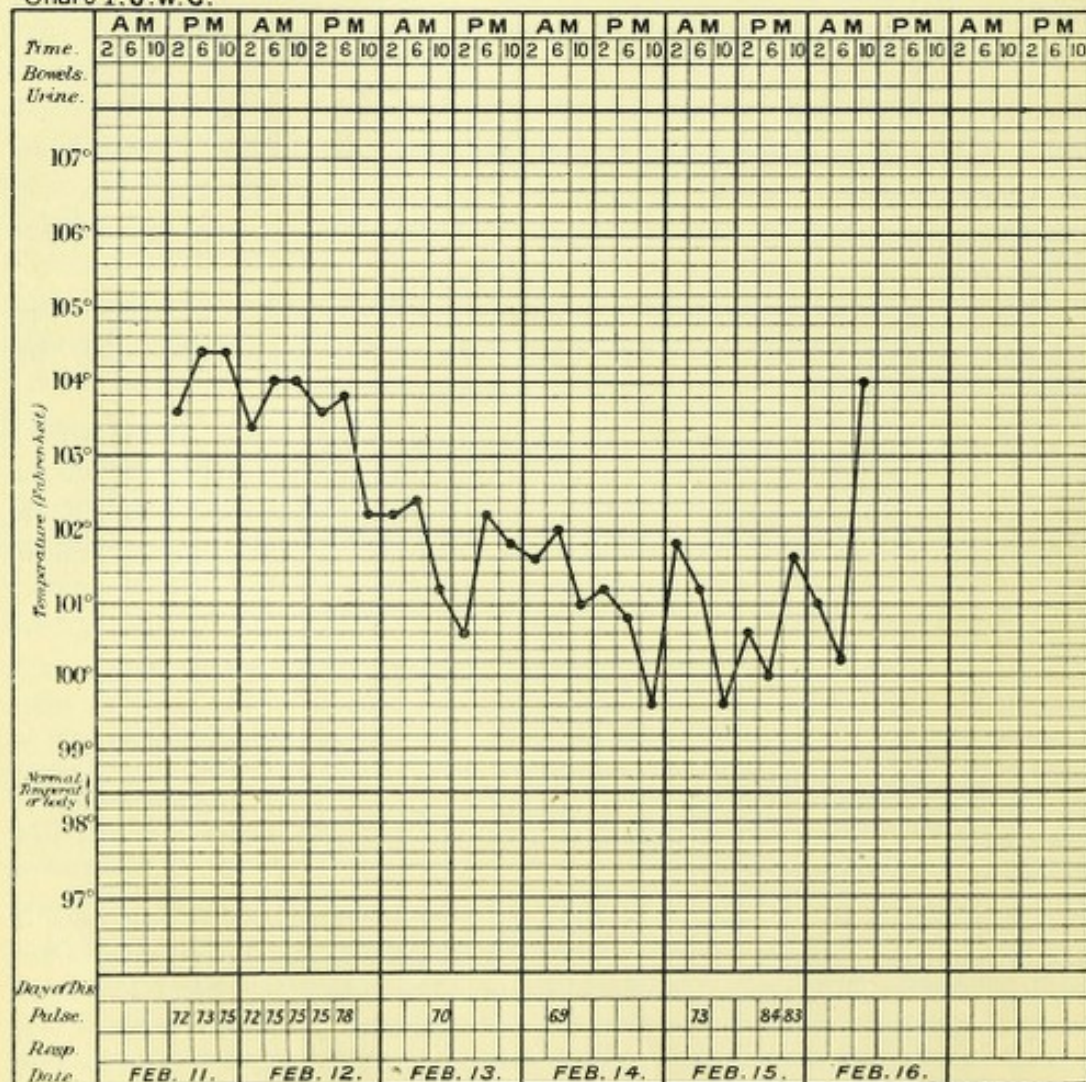
On February 14.—Was delirious during the night, given sulphonol, grs. 20, repeated. No sleep. Patient is in a drowsy condition. Fever is 102°. Urine has returned to dark bilious colour and passed only 6 oz. during the night. Albumin has increased considerably.

On February 15.—Patient is drowsy, although when spoken to answers intelligently and is quite lively. Bowels open—stools still light slate colour; very offensive. Taking nourishment well but has to be pressed. Has vomited twice, merely undigested food. Towards night drowsiness increased to stupor. Urine had improved, having passed 12 ozs. Towards morning became unconscious, and death was preceded by convulsions. No post mortem was made.

Mr. C. was an employé of the Belize Estate and Produce Company, Agents for the Harrison Line, whose S.S. "Barrister," arrived in Belize on February 7, from Colon, but enquiry does not reveal that Mr. C. went on board, or that any other employé of the Company became ill.

The case is extremely suspicious. There is want of correlation between the pulse and the temperature, albumin appeared in the urine, there was some jaundice and gastric irritability, and he was a recent arrival. The following is the chart:—

Chart I. J. W. C.



February 19.—Mrs. F. followed about the 19th of February in same house as J. J. F.; here again the main features were headache, jaundiced conjunctivæ (very slight), anorexia and nausea. No vomiting; fever did not exceed 103°, pulse not recorded.

February 11.—Simultaneously with Mr. J. W. C., the two sons of Mr. Ch., living next to Mr. J. J. F. were down, and Mrs. Ch. followed a week later. Mrs. Ch. had severe gastric symptoms and discoloured scleræ, but there was nothing of such a special nature to enable one to certify that it was a suspicious case.

Mr. J. T., living at the Jail, then followed. In this case there was a distinct difference between the pulse and the temperature. Temperature 104° , pulse 88. Later albumin was noticed in the urine and the eyes were distinctly jaundiced. Mrs. T. followed a couple of days later. She, too, had jaundiced eyes, but there was no great difference in pulse and temperature, and urine had no albumin.

Dr. Harrison, who attended the above cases, added that he has no doubt in his mind now that a good many cases which he saw previous to the outbreak of the epidemic were mild "ambulatory," cases of yellow fever.

Early in April the two brothers V. suffered from an attack of malarial fever; they recovered. Later the father, mother and three sons, including the boys who had recovered from the malaria, developed symptoms of a severe form of what was diagnosed as pernicious malaria. They were staying at the time at St. John's High School, immediately opposite Government House. These cases have been regarded as very suspicious, but I was not able to obtain further information about the cases.

April 19.—Dr. HEUSNER, aged 33 (born in Belize), Regent Street, was taken ill with chill and pains in body, accompanied by sudden rise of temperature to 103° . Severe vomiting on following day. Trace of albumin. On fourth day temperature fell, and recovery rapid. Scleræ became yellow. Dr. Heusner is of opinion that his case was very suspicious.

May 1.—A CHILD of the Rev. Mr. Crook, living in the Rectory, close to Government House, was taken ill with fever, which was regarded as malarial fever, but it might have been a mild case of yellow fever, for on May 4th Miss B., in the same house, took ill, recovered, but on May 10th had a rigor, and died of yellow fever on May 14th.

Miss B., governess to Rev. C. Crook at the Rectory. Had come to Belize with the Rev. Mr. and Mrs. Crook and two children about eighteen months previously. Temperature on 4th May 103° , pulse 120. Gastric irritability such as seen in bilious remittent fever. No headache or back-ache, no albumin. Much prostration. On the 7th, 8th, and 9th pulse almost normal, and patient appeared to have recovered.

May 10.—On the 10th temperature rose to 103° , and remained almost stationary till death. Little vomiting until 2 a.m. on the 14th when patient vomited an enormous quantity of brown fluid, and passed a large quantity of black fluid from the bowel, and died from collapse in half an hour.

There is some doubt here as to whether the first part of the illness was malaria or yellow fever. There was no jaundice, and the pulse was 130 on the 13th. "No precautions were taken against mosquitoes, and the house was one of the worst in the town for them." The case was not diagnosed.

May 6.—The Rev. Mr. C. developed a suspicious illness in a house opposite St. John's Church, at the back of Government House. There was high temperature, vomiting, but no blood. Quinine had no effect. Recovery.

May 7.—F., Rectory Lane, near Government House. Case was reported as malarial fever at the time, but the medical attendant now regards it as suspicious. Recovery.

May 12.—Father M., living at the Roman Catholic Church, aged about 38. Two years in Belize. Temperature 102° , pulse 84. On the third day temperature 99° , pulse 60. Skin slightly yellow, stools black. No albumin and no vomiting. Recovery. The medical attendant now regards the case with suspicion.

May 14.—C. R. D., aged 38, from Nassau, where he had resided for past four years, staying at the International Hotel. Was taken ill with severe chill, temperature of 103.4° , pulse 120, and headache. On May 16th temperature was 103° , pulse 80, tongue furred on top, with reddened edges. Breath foul. On the 18th temperature fell to 101° , but rose again to 102.4° , pulse 72 and 74. Scleræ yellow. No albumin. After this the temperature gradually fell and patient was discharged on the 31st. Probably a mild case of yellow fever.

FIRST OFFICIAL NOTIFICATION OF YELLOW FEVER.

May 16.—Rev. Mr. CROOK.—The Crook family removed to the Wesleyan High School, and at 2 p.m. same day the Rev. Mr. Crook took ill. Rigor, temperature 104° . 19th, temperature 102° . 20th, temperature 104° . Black vomit. Pulse 48. Albumin in urine. Palate congested with numerous petechial spots. Conjunctivæ congested, yellow, skin bronzed. There was no doubt about the nature of the case, and on 21st May, Governor informed (in order that he might send for the Colonial Surgeon), and case shown to the U.S.M.H.S. Officer, who cabled Washington. Death occurred on May 24th.

P.M.—*Stomach*, quantity of black vomit present.

Liver and Heart, fatty. The appearances are described as typical.

The medical practitioners of Belize, including Dr. Carson, representing the Public Health and Marine Hospital Services of the United States were present.

May 16.—E. M., male, aged 27, native of Germany. Mercantile Clerk, living in Gabourel Lane. Taken ill with rise of temperature to 103° , pulse 120. Dr. Heusner now regards the case as very suspicious.

May 16.—Drury B., aged 7 years, son of Major B., about one year in Belize, residing in Market Square. Fever lasted for five days, then began to remit. The pulse and temperature did not disagree. There was marked hypostasis of the skin. The case is regarded as suspicious. Major B. took ill with yellow fever on June 24th, that is a month later.

May 17.—Rev. Mr. H., at Mrs. F.'s, where there had been a case of fever on the 7th, Rectory Lane. Fever, severe vomiting, constipated, tarry stools, slow pulse, jaundice not marked. Ill from 18th to 26th. Medical attendant has no doubt that it was a case of yellow fever. Recovery.

May 20.—Mr. F. W., a white man, had been in Belize about one month. Symptoms such that the medical attendant has now little doubt that the case was one of yellow fever.

May 22.—Dr. CRAN.—Dr. Cran now is of the opinion that he had a slight attack of yellow fever. Intense headache and backache with darting pains. Temperature $100-102^{\circ}$. Pulse 56, bowels constipated, tarry and offensive, vomiting of mucus. No albumin in urine.

May 22.—G. A., aged 14, native of United States, living in Regent Street. Temperature on 4th day 102.8° , pulse 96. Illness 9 days' duration. Recovery. Physician regards the case now as suspicious.

May 22.—I. T., aged 9 years, native of town, living corner of Prince and Regent Street. Temperature on 1st day 104.4° , pulse 90, then fell and rose on 5th day, when patient died. There was black vomit. Case diagnosed yellow fever.

The following eight cases are of exceptional interest. They are the officers and crew of the S.S. "Whitehall," which was stranded on the coast of British Honduras on May 7th, and who arrived in Belize on about the 11th of May, and put up at the International and Union Hotels which are opposite one another. The "Whitehall" came from Cuba, but no cases of fever occurred on board. With the exception of the case of Captain Berglund, none of the cases were regarded at the time as yellow fever, there can, however, now be little doubt that the new arrivals really suffered from Yellow fever contracted in Belize.

The first case occurred on May 17th.

ANDRES SAN PEDRO, aged 33, Spaniard, admitted into hospital complaining of headache, bowels constipated, face flushed, tongue coated, temperature 101.8° , no enlargement of spleen, no epigastric tenderness. On the 17th temperature rose to 104° , pulse 116, gums good. On the 20th temperature 102° , pulse 70. Urine no albumin. On 23rd much better.

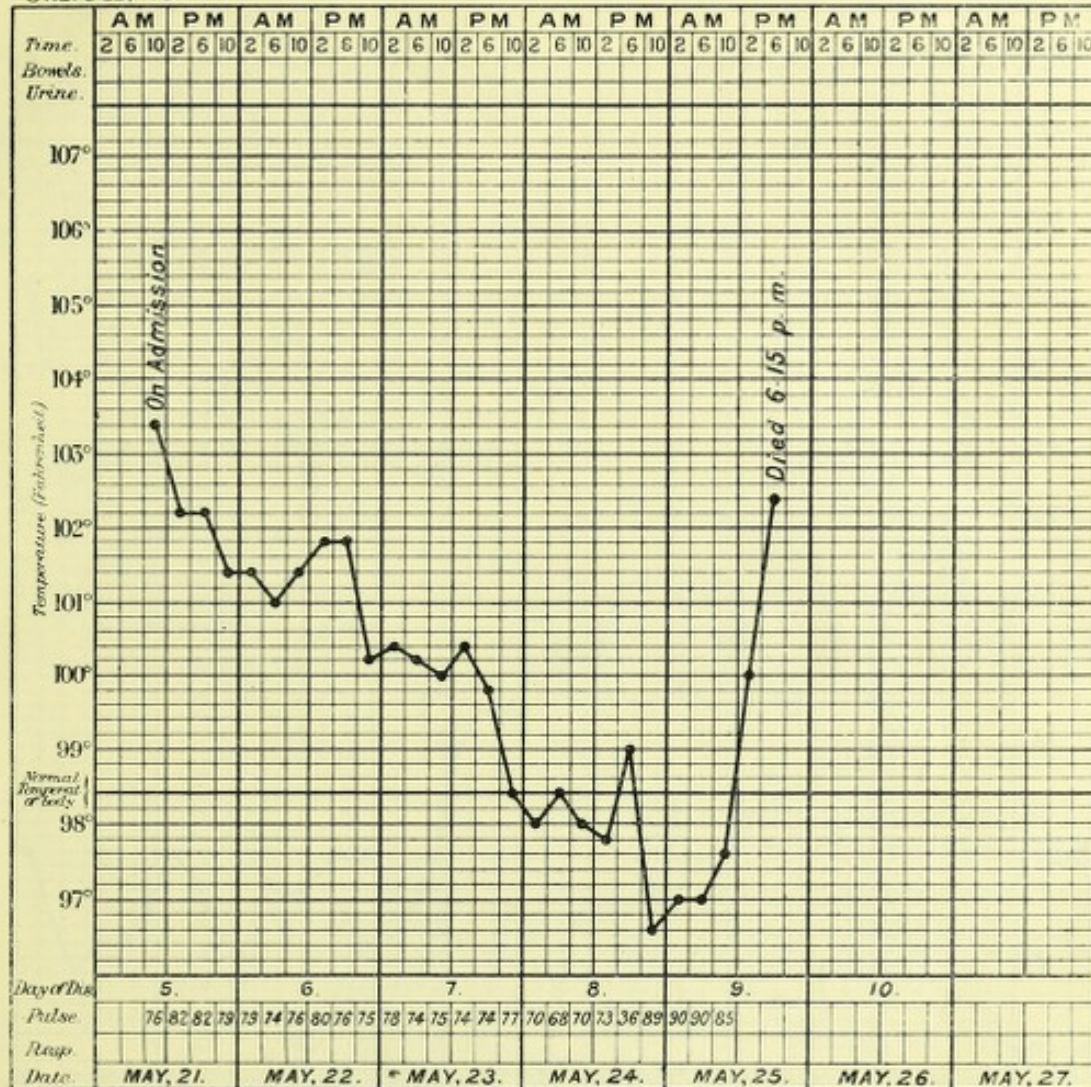
On May 18 FRANK BOWES, Chief Engineer, S.S. "Whitehall," complained of headache, constipation, could not sleep. Temperature 101° , pulse 100. Next day better, but on 21st much worse, retching, temperature 103° , pulse 76. No albumin in urine. Albumin present on the 22nd.

On the 23rd retching continuous, temperature 100.2° pulse 74. Urine contains albumin.

Became delirious, and died on the 25th. Post-mortem examination confirmed diagnosis of yellow fever.

Chart :—

Chart II, F.B.



May 20. OLAF BERGLUND.—Aged 44, Swede, Captain of the "Whitehall," staying at the International Hotel. Was admitted to the Hospital on the 20th, but had been visited by Dr. Harrison on the 18th, when temperature was 103° and pulse 130.

On 19th much nausea, temperature 103° , pulse 120, vomited bile and frothy matter. On 21st pulse became worse, delirious, very weak, temperature 102° , pulse 100, final collapse and death.

At the post-mortem it was found that the liver was slightly yellowish, but no congestion of the stomach wall. The medical representative of the United States Marine Service, who saw the case, diagnosed yellow fever and reported it.

May 21.—WILLIAM HARDING, aged 40, English, the cook to the "Whitehall." Admitted complaining of headache and backache. Temperature 102° , pulse 99. Temperature and pulse gradually lowered, and convalescent on the 25th.

May 22.—JOZA ANTONIA, aged 33, Italian seaman. On admission, temperature 99° , pulse 60. Headache severe, eyes congested. On 24th temperature 102.8° , pulse 90, no albumin, no nausea. Gradually recovered, and discharged on June 6th.

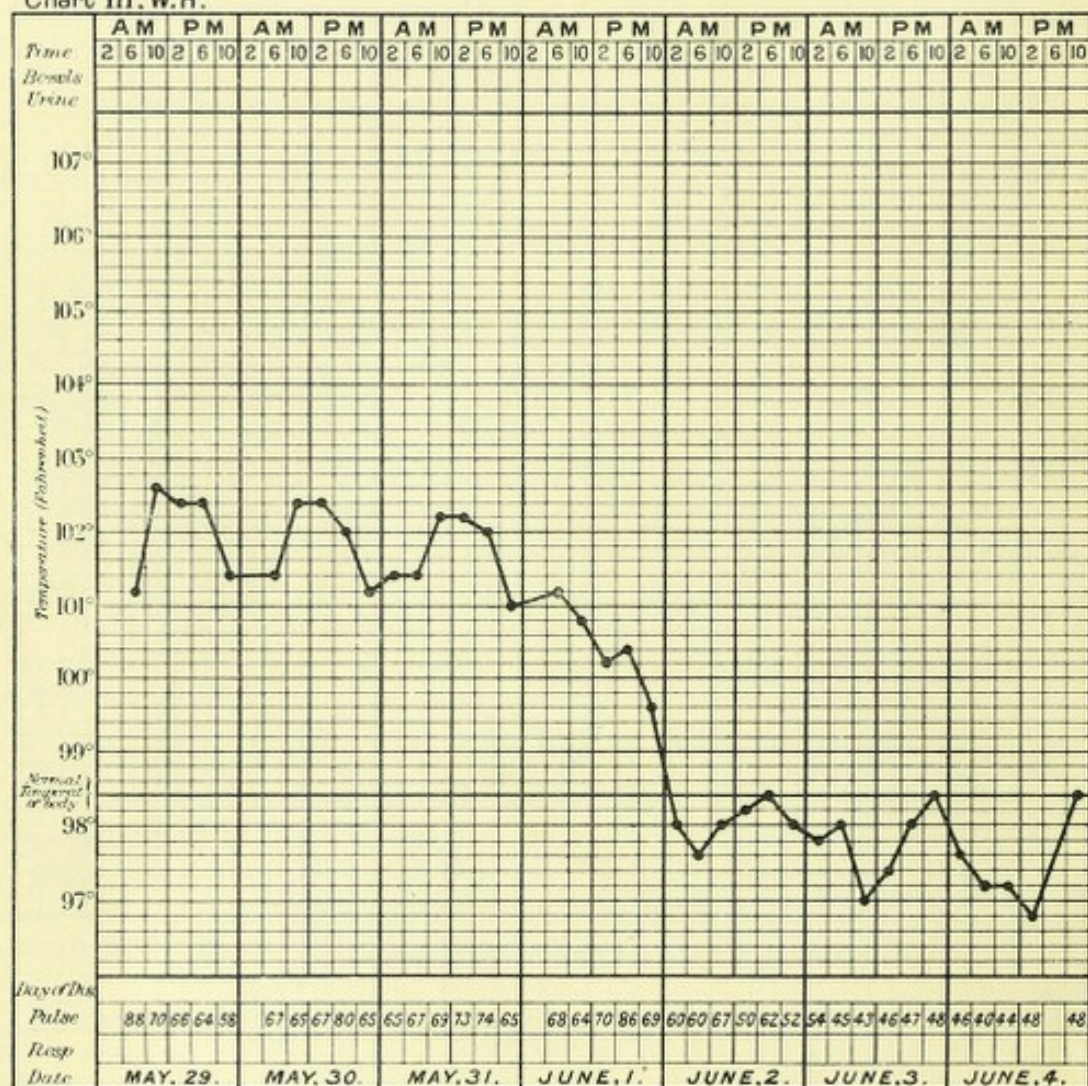
May 24.—PETER ZAIGOL, Austrian seaman. Temperature 103.6° , pulse 90. Headache and backache, eyes congested, great weakness, urine albuminous. Made good recovery, and discharged June 5th.

May 27.—GIUSEPPE PEROA, aged 30, Italian. Commenced with chill. Temperature 106.6° . Sclerae slightly jaundiced, headache and backache, trace of albumin. Recovered, and discharged June 6th.

May 29.—WILLIAM HANSEN, Norwegian seaman. Admitted with headache, flushed, epigastric tenderness. Temperature 101.2° , pulse 88. Albumin present on 5th day. Recovery.

Chart :—

Chart III, W.H.

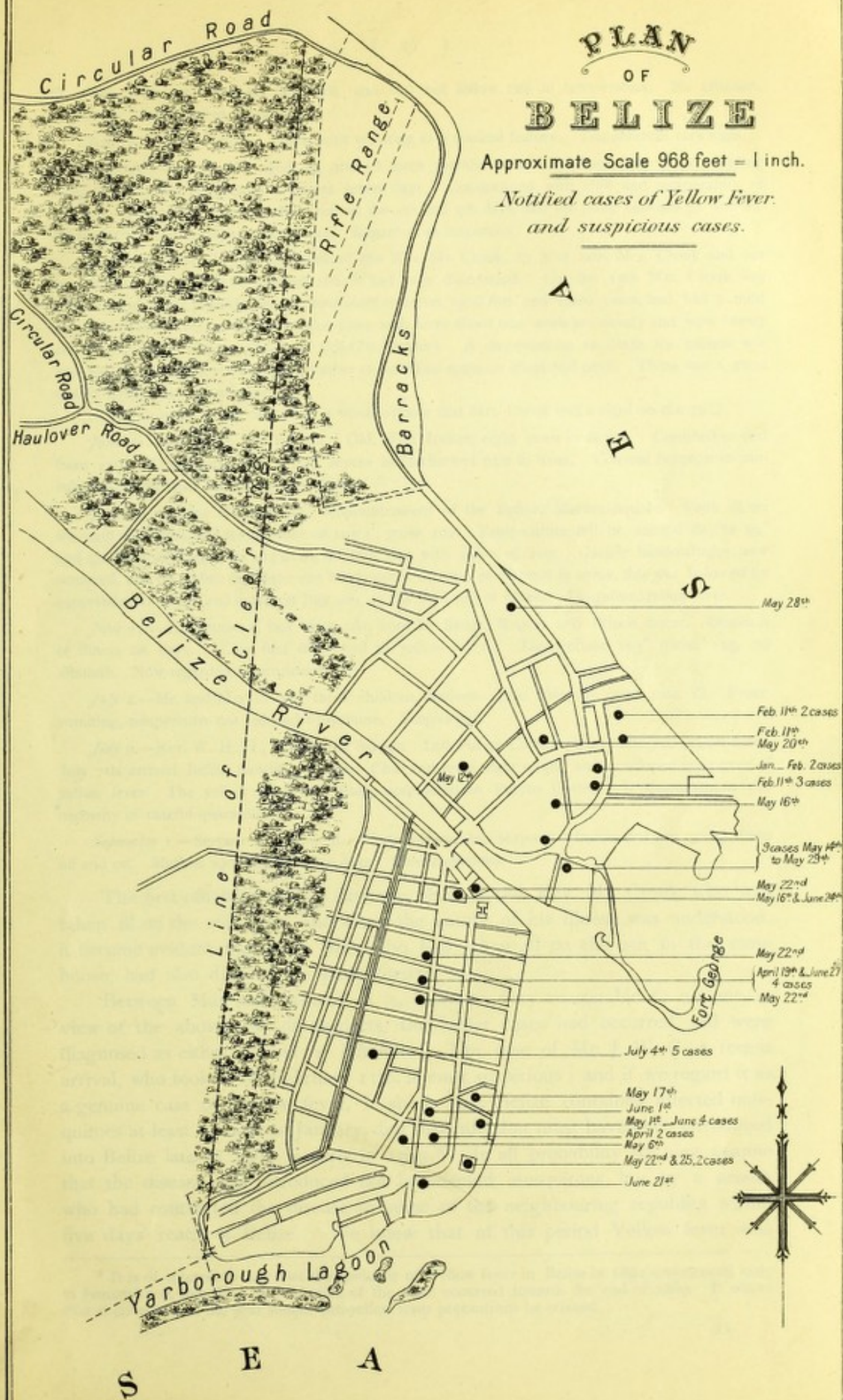


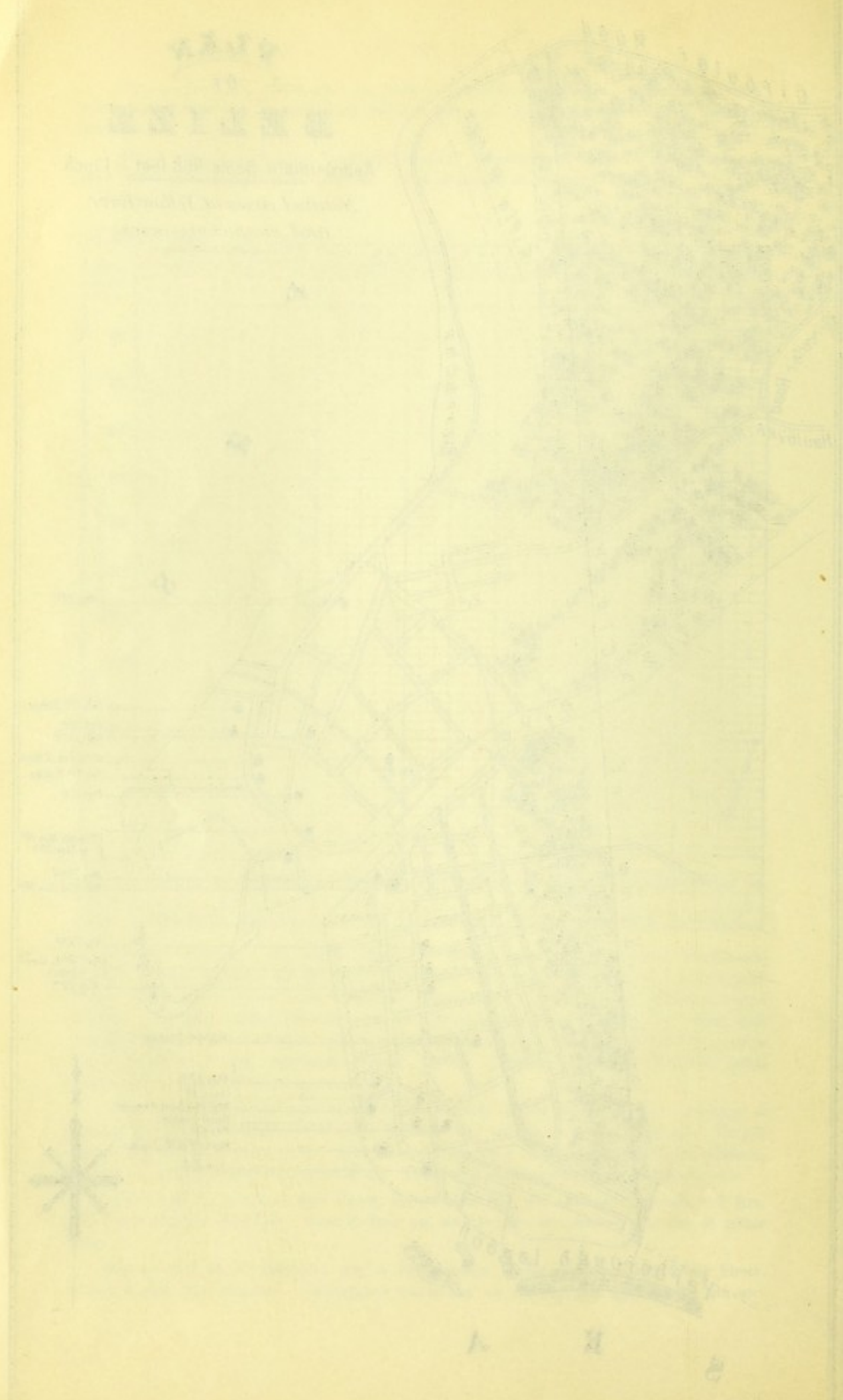
May 22.—Miss N. S. E., English, aged 20. Recent arrival in the Colony, Government House. General malaise since the 20th. Complains of feeling bilious, headache. Face flushed, tongue furred, gums normal, eyes congested. Temperature 103° , pulse 110. Sclerae jaundiced anorexia. On 24th, vomiting increased. On the 25th could not retain anything, and vomits dark flocculent matter, trace of albumin. On the 26th vomiting increased. On the 27th vomit completely black. Quantity of urine decreased, albumin distinct. Delirious. Vomiting increased, partial suppression of urine, and death on the 28th.

May 25.—Major H. P., aged 27. English. Recent arrival in the Colony. Residing at Government House. Complained of severe headache and burning of eyes, also nausea. Tongue very slightly furred. Gums good. Eyes clear. Urine Sp.g. 1.020, quantity good, no albumin. Recovery. Patient's pulse went as low as 45. There were no other symptoms. Suspicious case.

June 1.—M. L., servant to Mrs. Crook, nursed Miss Bills who died on May 14th, and Rev. Mr. Crook who died May 24th. Took ill June 1st, and Dr. Davies considers case one of yellow fever.

June 4.—Mrs. H. K. HEUSNER, wife of Dr. Heusner, corner of Regent and Prince Street. Illness of nine days' duration. Temperature rose to 102° on 2nd day, and again on the 4th an





the days. Pulse at first 120, later fell, and did not follow rise in temperature. No albumin. Recovery. Regarded as suspicious.

June 7.—L. N., Native. Fever, with vomiting as a marked feature. Temperature very high.

June 11.—Miss C. H., aged 19, arrived three months previously from New York, residing Regent Street and Palm Lane. Illness seven days. Commenced with chill and temperature of 100·6°. Temperature remained at 100° on the 4th and 5th days, and the pulse between 72 and 80. Stools tarry. Urine scanty. Recovery. Regarded as suspicious.

June 15.—A week after the death of the Rev. Mr. Crook, on May 24th, Mrs. Crook and her two children returned to the Rectory after it had been disinfected. On the 15th Mrs. Crook was taken ill and it was possible that her two small children, aged five and three years, had had a mild attack of yellow fever, as they were also down with fever about one week previously and were barely convalescent when their mother took sick (Dr. Davies). A day previous to death the patient was very yellow and there were a large number of petechial spots on chest and neck. There was a great deal of dysphagia. Death June 22.

(From an entry in the case book it would appear that Mrs. Crook had a rigor on the 7th.)

June 21.—Mr. D. F., the Retreat. Old West Indian, eight years in Belize. Confined to bed from 21st. Temperature 101°, very severe headache and pain in loins. Colonial Surgeon in consultation agreed that case was yellow fever.

June 24.—Major B., aged 41. Superintendent of the Police, Market Square. Took ill on the 24th with chill, and temperature of 103·4°, pulse 102. Temperature fell on second day to 99° and gradually rose again to 103·4° on the fifth day, with pulse of 100. Gastric hæmorrhages now occurred, and on eighth day there was black vomit, increase of albumin in urine, this was followed by suppression of urine, and death on July 4th, on the 11th day of illness. Diagnosis, yellow fever.

June 27.—L. HEUSNER, four years old, born in Belize, Regent and Prince Street. Duration of illness six days. Case first diagnosed as yellow fever. Temperature 103°, pulse 124, no albumin. Now regarded as suspicious.

July 4.—Mr. and Mrs. C. and three children, Natives. One after the other took ill. Fever, vomiting, temperature not reduced by quinine. Suspicious.

July 9.—Rev. W. H. H., Quarantine Station. Left Puerto Cortes, where there was yellow fever, July 7th, arrived Belize morning of 9th. Chill and fever night of 9th, and developed symptoms of yellow fever. The yellow fever was clearly contracted in Puerto Cortes. It demonstrates the necessity of careful quarantine.

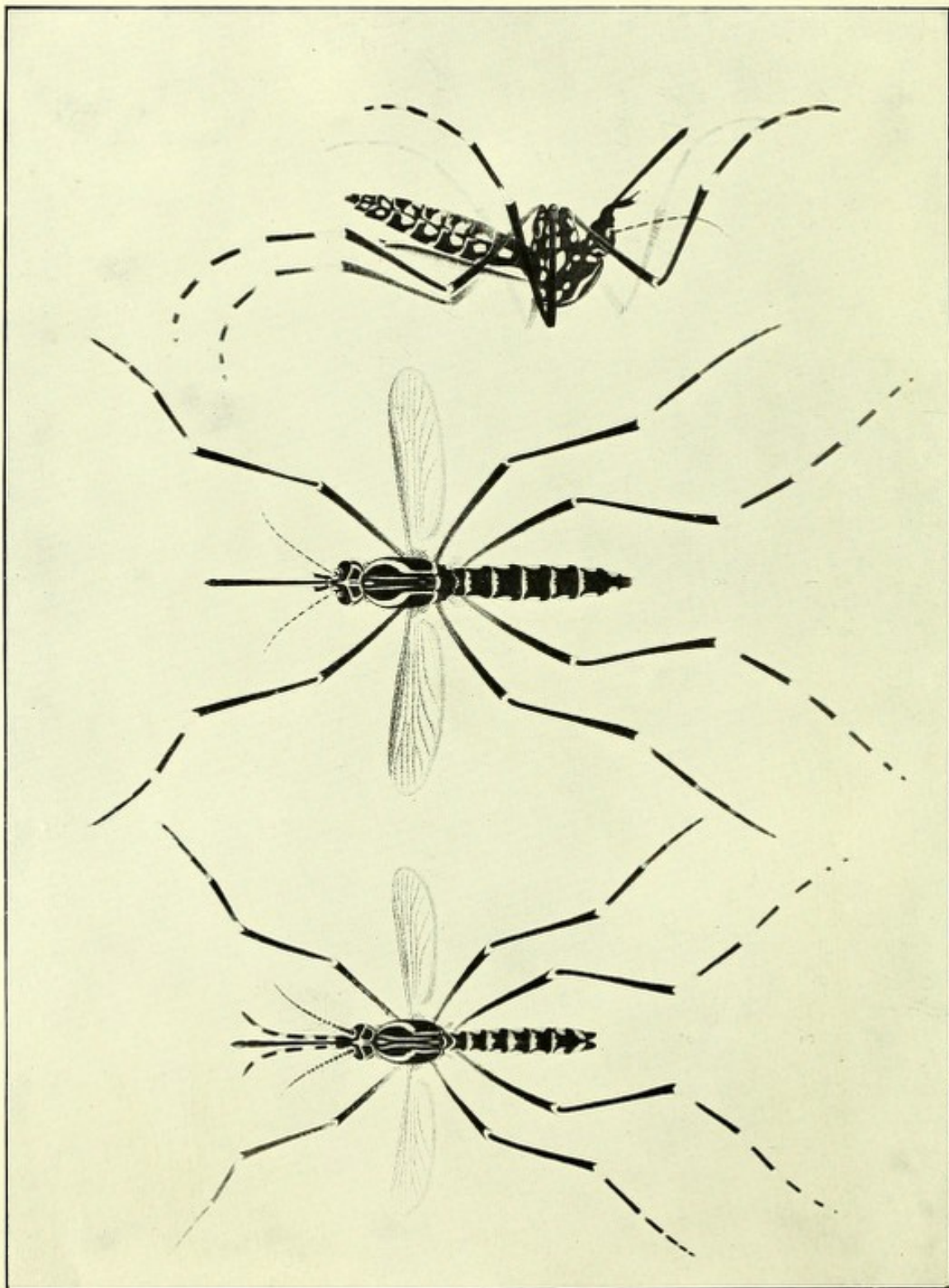
September 1.—Servant to Major B. Had, however, left Major B.'s house, but was going there off and on. Marked vomiting for three days. Case suspicious.

The first officially notified case was that of the Rev. Mr. Crook, who was taken ill on the 16th May, and when the nature of his illness was understood, it became evident that Miss Bills, who had taken ill on the 4th in the same house, had also died of the same disease.

Between May and January it is, however, very reasonable to assume, in view of the above list of suspects, that other cases had occurred and were diagnosed as either malaria or influenza. The case of Mr. J. W. C., a recent arrival, who took ill on February 11th, is most suspicious; and if we regard it as a genuine case of Yellow fever, it shows that Belize contained infected mosquitoes at least as early as January, and that infection must have been introduced into Belize late in 1904 or early in 1905.* In all probability we may assume that the disease was introduced not by infected mosquitoes, but by a person who had contracted the disease in some of the neighbouring republics within five days' reach of Belize. We know that at this period Yellow fever was

* It is of interest to note that the epidemic of Yellow fever in Belize in 1890 commenced early in January, and, therefore, that infection of the town occurred towards the end of 1889. It shows that at no season of the year should anti-yellow fever precautions be relaxed.

present in the Mexican Republic and in the Isthmus, and although the date of origin of the very severe outbreak of Yellow fever in Spanish Honduras and Guatemala is put down as occurring in the month of May, or even later, there is the possibility that infection was present in both countries at a much earlier date, and that, therefore, the disease might have also been introduced from either of these countries. Admittedly it is a very difficult matter to trace the source of infection, but we may venture to surmise that it was introduced very early in the year by way of the shipping, at a time when it was not expected, and quarantine supervision not so severe as it would have been had the danger been realised. The outbreak demonstrates the necessity of constant quarantine supervision in the Yellow Fever Zone, and of putting the city in such a sanitary state that it will in future be impossible for Yellow fever to spread. There appears to be little doubt that by June there was very general infection of the mosquitoes throughout Belize, for cases occurred scattered both in the north and south portions of the town. After June the disease dies down, not in my opinion from the anti-mosquito measures which were taken, which were not sufficient to appreciably reduce the number of the *Stegomyia*, as will be shown later on, but from the absence of the arrival of fresh susceptible non-immunes. The remarkable instance of the crew of the S.S. "Whitehall," who arrived on the 11th May in Belize, and who began to show suspicious symptoms on the 17th, shows that if we accept them as cases of Yellow fever, and there seems little reason to doubt their genuineness, that new arrivals very soon contracted the disease.



STEGOMYIA FASCIATA, FABRICIUS, Male, Female, and side view; magnified about 20 times.
(From "Os Mosquito no Para." by Dr. GOELDI.)

CHAPTER II.

PROPHYLACTIC MEASURES AGAINST YELLOW FEVER.

IN JUNE, 1900, Army Surgeons Reed, Carroll, Lazear and Agramonte were sent to Cuba to study Yellow fever, and succeeded, by most exact and convincing experiments, to prove conclusively the rôle of the *Stegomyia fasciata* in transmitting yellow fever. In the same year an expedition was sent from England to Para, an endemic focus of the disease in Brazil, and very shortly afterwards France and Germany followed with other scientific commissions. The Marine Hospital Service established early in 1902 a Yellow Fever Institute to study the ætiology and transmission of the disease, and sent out working parties to Vera Cruz and other places to obtain information on the spot. Mexico and Brazil have co-operated in these investigations, and most recently the Liverpool School of Tropical Medicine has, for a second time, established an observation laboratory at Para. A group of skilled workers has therefore been applied to the elucidation of this disease, with the result that the original experiments of Reed, Carroll, Agramonte and Lazear have been fully confirmed, and that the sole transmitter of the disease has been proved by repeated experiment to be the *Stegomyia fasciata*. If an example were necessary of the devotion of these workers to the problems before them, it is furnished by the fact that a large proportion of them contracted the disease, and that several died.

The result of the mass of exact scientific information which has been obtained by these investigators was soon made evident by those whose duty it is to take practical measures to eradicate Yellow fever. The first great application took place in Havana in 1901, and was carried out by Major Gorgas under the very efficient administration of General Wood. The result is well known, it was a great success. Since then similar methods have been employed in the United States, Mexico and South America, whilst this summer the opportunity was afforded at New Orleans of testing the method upon a still more extensive scale than heretofore.

There is now no longer any doubt as to what are the prophylactic measures, nor as to how they should be carried out. The measures are neither complex, costly nor wasteful, but they require absolute conscientiousness, precision and rapidity of action to carry them out. From my observations this summer I am convinced that this is not realised, and that a very large part of prophylaxis is waste, brings about a sense of false security, and, I am of opinion, also unnecessary sacrifice of life.

I will group and describe the measures necessary to adopt under the following heads :—

- | | | |
|--------------------|---|---|
| In connection with | { | 1. Early notification and danger of concealment of cases. |
| Patient and | | 2. Isolation Hospitals. |
| infected mosquito. | | 3. Screening Patients. |
| | | 4. Fumigation and fumigating materials. |

- | | | |
|--|---|--|
| In connection with
eradication of the
<i>Stegomyia</i> . | { | 5. <i>Stegomyia</i> survey.
6. Screening of water supply. Oiling.
7. Necessity of screening water supply in vicinity of
wharfs.
8. Mosquito nets and the screening of houses.
9. Antimosquito propaganda. |
|--|---|--|

1.—EARLY NOTIFICATION.

Careful enquiry into the numerous epidemics in the Southern States and in the Fruit Ports of Central America this summer proves conclusively that Yellow fever had gained a firm foothold before the first cases were notified.

In Central and Southern American Ports this will prove for a considerable time to come a perpetual source of danger, for the inhabitants of these districts are likely to be more indifferent to the disease, and therefore to be less careful about notification. No doubt this is also the reason why it is laid such stress upon in the opening Articles of the Washington Convention of 1905. Commercial reasons, it is alleged, may sometimes operate to hold back notification, but the lesson of this year shows that the risk of the losses brought about by allowing the fever to gain a head is too great. In a modern city swarming with the *Stegomyia*, a concealed case must sooner or later make itself manifest, and by the time it does so, the total volume of mosquito infection will be so great that serious disaster is inevitable. Commercial and civic authorities now realise this, so that the danger from suppression of the facts is diminishing. More often the loss of time in early notification is due to the fact, either that cases of the disease are present amongst the indigenous inhabitants (Central and Southern America), or breaks out amongst a particular colony of labourers in a town or district, such as amongst the Sicilians and Italians in New Orleans this year (1905), who do not readily seek medical advice, and are often exceedingly suspicious, or that early cases are not recognised. In districts where malaria takes a pernicious form, or where Dengue is common, the difficulties of diagnosis must be greatly increased, and experience under these circumstances will be of great value. On the other hand, some other epidemic may have preceded the Yellow fever, and cases which were in reality yellow fever may have been placed to the credit of the former.

In large cities, as mentioned in the previous chapter, a clue that something unusual is happening may be afforded by analysis of the weekly death returns. A sudden rise in the number of deaths recorded from malaria in a month, at a season of the year when malaria has not occurred in previous years, would be a very suspicious element. In small towns, however, such indications would probably be too slight to be of practical value in putting a community upon its guard.

Where the practitioners themselves have had the advantage of previous experience in the disease there is a greater chance of early notification. But I venture to suggest that experience gained of Yellow fever or any other disease twenty or fourteen years previously, is not so valuable as experience of the disease acquired since our knowledge of the disease has been very greatly increased. For this reason I urge that it would be wise for one or more of the Government Medical Officers of the Colony to be sent, as occasion arises,

to study any particular disease affecting the prosperity of the Colony, to some place where the particular disease is common. This is one of the chief reasons why the medical officers of the Marine Hospital Service are of such practical service to the United States.

Of supreme importance also is the necessity of obtaining a post-mortem examination of the first suspicious death. The post-mortem findings are characteristic, and do not need microscopic confirmation.

The notification of Yellow fever is rightly regarded as a very serious matter, and a young practitioner will undoubtedly hesitate before he declares. If he has notified, and the case does not turn out to be yellow fever as he supposed, he regards his diagnostic power as open to criticism, both by other doctors and by the patient. If he is dealing with a genuine case, and he hesitates till too late, no fumigation is undertaken to kill the infected mosquitoes at the outset, and in the meantime contagion is spread to make itself felt some twelve days afterwards in the same house or in the vicinity. The situation is unquestionably difficult, and it can only be got over by friendly inter-reliance amongst the medical men themselves, and by the encouragement given by the Senior Medical Officer to his juniors not to hesitate to express their difficulties to him nor to think that thereby they suffer in his estimation as careful observers¹. I am convinced that this is very necessary, as there is evidence that this spirit is not always carried out. The action taken on the initiative of the New Orleans Medical Society this year, and also later by Dr. White, in command of the Federal Public Health Service in New Orleans, is of great interest here, for both communications show that those who were best capable of judging, knew the difficulties to be encountered in prompt notification and in mistaken diagnosis. I reproduce for future guidance the letters in full which were sent to every medical man.

NOTICE TO THE MEDICAL PROFESSION.

U.S. PUBLIC HEALTH AND MARINE HOSPITAL SERVICE.

NEW ORLEANS, August, 1905.

Dr.....

DEAR DOCTOR,

Considering the imperative necessity of instituting at the earliest possible moment prophylactic measures in the case of any person suffering of a fever which may subsequently be shown to be yellow fever, you are urgently requested to report to this office not only any case of fever which you may be sure is Yellow fever, but also **any case you may be unable**, even at your first visit, to say is not yellow fever.

We enclose you cards which will facilitate your report of such cases, and will at the same time give us your authorization to inspect the said premises, and to do whatever may be necessary to prevent the extension of the infection in the house or neighbourhood.

We give you our assurance that your rights as the attending physician will be fully respected, and that our inspectors will make no attempt to examine the patient, or in any manner endeavour to influence your diagnosis or treatment of the case.

We shall await your final determination of the case, but hold ourselves ready to serve you with a consultation free of charge to your patient from the enclosed list of gentlemen, who have consented at our request to aid this office in the clearing up of any doubtful diagnosis.

¹Reed and Carrol wrote "the chief duty of quarantine officers hereafter will consist in the detection of mild or very mild cases of yellow fever. In a series of twelve cases of experimental yellow fever produced by the bite of *Stegomyia fasciata*, we have elsewhere pointed out that four, of 33%, were mild or very mild in character, and have indicated the difficulty of making a positive diagnosis in such cases."

Feeling sure you will understand the spirit which prompts this communication—the desire simply to get the co-operation of the entire profession of this city in the checking of the multiplication of a new foci of infection, and the early destruction of those already existing.

I am,

Yours very truly,

J. H. WHITE,

Surgeon, P.H. and M.H.S.

ORLEANS PARISH MEDICAL SOCIETY.

NEW ORLEANS.

July 24, 1905.

DEAR DOCTOR,

We want to specially urge you to report all your cases of fever—malarial, typhoid fever, or fever of any kind—during this summer, to the City Board of Health.

It is absolutely essential to the checking of the spread of Yellow fever in our city, that all cases should be promptly and conscientiously reported.

Our patients, the public, and the surrounding communities, will naturally look to our profession in this great emergency, and the responsibility rests in a great measure with us to check this condition, or at least to limit its too extensive spread. It is a well-known and scientifically proven dogma that the mosquito theory is to be accepted as a fact; then we must exert ourselves to the utmost to destroy the mosquito, the only host of transmission of Yellow fever. Let us, then, make a consistent campaign against it, educate our patients regarding this situation and the danger of it, and direct them to place patients immediately under netting, pending action of the Board of Health. Neither your patient nor the household will be subjected to the obnoxious house quarantine of several years ago.

Above all things, **report your cases promptly**, to permit us to check any further foci of infection.

Even if you are not positive that the mosquito is the only source of transmission of Yellow fever, give your city the benefit of the doubt in this important and vital matter.

Respectfully,

(Signed) EDMOND SOUCHON, M.D.,

President Louisiana State Board of Health.

QUITMAN KOHNKE, M.D.,

Health Office of the City of New Orleans.

J. H. WHITE, M.D.,

Surgeon U.S. Public Health and Marine Hospital Service, in charge of Government Measures.

ADVISORY COMMITTEE ORLEANS PARISH MEDICAL SOCIETY.

John Callan, M.D.,

M. J. Magruder, M.D.,

John F. Oechsner, M.D.,

L. G. LeBeuf, M.D., *Chairman.*

After the first official notification of the disease in Belize, the Colonial Surgeon also addressed a letter to the local Practitioners, in which he states:—

“ In view of the reported case of Yellow fever, I would deem it a favour if you would give me opportunities of seeing with you in your practice such cases as may occur, or even in which there may be cause to suspect Yellow fever. I make this request so that I may be able to report on the outbreak and advise the Governor, for not being in private practice I have to rely on the courtesy of practitioners to afford me opportunities of seeing cases.”

These letters show that reliance must be placed upon the medical men to notify to the health authorities the first suspicious cases, and that consultation is essential.¹

It sometimes happens, however, and examples have occurred this year, that rumour, or a sanitary inspector, directs attention to a suspicious case in some part of the town, usually amongst the poor; there may, for instance, be a direct attempt at concealment. Under these circumstances the Health Officer should have power of entry into the house.

Concealment of Cases.—A concealed case is a very serious danger, as it may lead to the infection of mosquitoes which may communicate the disease to surrounding houses over a considerable area. I do not gather from examination of the Public Health Ordinance, Belize, 1894, that there is any clause covering a case of this kind. At the period when the Ordinance was framed, the rôle which mosquitoes played in dissemination of disease was not known; now, however, that their share is well understood, it would, in my opinion, be most advisable to make an Ordinance to prevent the form of nuisance arising from the concealment of a case of Yellow fever.

By Ordinance 63 of the Public Health Ordinance, Belize, 1894, the Central Board may make rules when necessary for the prevention and mitigation of infectious and epidemic disease (1) for the disinfection of houses, and (2) *for house to house visitation*. This latter has had to be resorted to in the case of New Orleans, and the results proved at once its great utility. I therefore recommend that the Board frame such rules as will enable the Medical Officer or his assistants to make a house-to-house inspection to be ready should the occasion arise.

2.—PROVISION FOR ISOLATION HOSPITAL.

The yellow fever this year found the majority of towns totally unprovided for the reception of Yellow fever cases. Schools and dilapidated houses had to be carefully screened and converted into isolation hospitals. New Orleans is now about to erect a suitable permanent isolation hospital for infectious cases, having had, however, to incur the expense of two emergency hospitals this summer.

A town of the size and importance of Belize should make provision for the reception of cases of plague, Yellow fever, or small-pox. A very small and simple hospital, carefully screened, would suffice, accommodation being made for twelve cases altogether. Experience demonstrates that it is impossible to obtain complete isolation amongst the poorer classes. It would be necessary, in order to make it effective, to place a sentry at the door of the sick room. Cases occurring amongst the poor should at once be removed under bars to the isolation hospital, and the medical men of the district might advantageously co-operate in bringing this about.² The same arguments against the cost of maintenance, such as the infrequency of use, may be employed here as well as in the case of expense in administering quarantine.

¹ In Havana it is obligatory, under penalty, for a physician to report at once all cases of a *suspicious character*, "Suspicious of Yellow Fever" is added to the notifiable list of fevers.

² There is often a prejudice amongst the poor against hospitals, and it is of great importance for the educated to show, by example, that the best place for the treatment and cure of Yellow fever is in the Special Hospital.

In my judgment, the simple provision which is necessary for the preservation of the Colony from those diseases which may shut it out from free intercourse with other countries has a greater claim on the administration than the local general hospitals intended for the reception of non-infectious diseases.

The local isolation hospital should not be confounded with the isolation hospital necessary for the proper execution of quarantine, the local hospital is for the reception of infectious cases coming from the town or country districts. A site for a small isolation hospital on the outskirts of the town could, I feel sure, be readily found.

3.—ISOLATION BY SCREENING THE PATIENT.

Both with regard to the isolation of the patient and the application of fumigation there is a great want of precision. It is useless for anyone to apply these two cardinal preventive measures unless they understand the rôle of the mosquito in the dissemination of the disease. The infected mosquitoes have to be destroyed both in the house of the patient and often in the adjoining blocks, and the patient must be so placed that no mosquitoes can gain access to him. Those who are familiar with the habits of mosquitoes know that it is not an easy task to bring about their thorough destruction in living houses, and that fumigation must be applied with absolute thoroughness to all parts of the house, closets and outhouses, and that to do this the house, closets and outhouses must be so completely sealed that a mosquito cannot get away through any chink. Again, those familiar with mosquitoes, know that it is very difficult to keep them out of screened rooms, unless the screening is well done and the doors are of the proper kind. It is only by the rigid application of these two methods that an epidemic can be stamped out quickly. In the hands of good men, experience has taught that both these measures can be applied with scientific precision.

I recommend that both the screening and fumigation in cases of fever be carried out under the direct supervision of the Medical Officer of Health and by his staff.

The staff of the Medical Officer should, without delay, be instructed how to seal a room, how to fumigate, and how to test the efficiency of the fumigation. The methods at present in vogue for fumigating and disinfecting for diphtheria, scarlet fever, &c., will not do.

A supply of the necessary materials for screening, including laths and frames, paper strips, fumigators and fumigating material should be kept in the Health Office for emergency purposes, and the Health Officer should know where he can immediately procure additional supplies. Simple rules for the guidance of the men should be drawn up.

In my judgment, in view of the fact that mosquito-borne diseases cause more sickness and mortality in the Tropics than those arising from any other cause, it is not too much to expect that sanitary inspectors and others attached to Health Offices in the Tropics should be taught the precautions to take against them; this is, however, frequently omitted, and instead they are taught principles of European sanitation, which are inadequate to deal with malaria or Yellow fever.

Screening the Patient and Room.—In either doubtful or well-marked cases the patient is to be at once placed under bars in charge of a nurse, and the room

screened. The entrance to the room is to be through double doors (air lock) provided for the purpose, the original door, if there was one, having been removed. The portable screens and doors used for the purpose may be made with wire gauze or bobinette, the standard minimum gauge of 18 meshes to the inch either way being used. Employing mosquito nets alone, or, as at Belize, portable screened chambers, is not sufficient. The presumption being that as the majority of infected mosquitoes are in the patient's room it is essential that both their egress from the chamber and the entrance of fresh ones be prevented.

If screening cannot be carried out in the patient's room, or there is reason to believe that the double doors will be left open or the screens to the windows interfered with, then, without hesitation, the patient should be removed in the screened ambulance to the isolation hospital, otherwise the patient becomes a source of infection in the district.¹

4. SEALING AND FUMIGATING.

Preparation for fumigation should have started with the screening. Not only the sick chamber, but very possibly also other rooms in the house harbour infected specimens of the *Stegomyia*. The rule of procedure should, however, be absolute, and that is, that the entire house must be fumigated, with the exception of the patient's room, which is screened. Incomplete and imperfect fumigation are the principal reasons of not being able more promptly to suppress yellow fever. The recent epidemic is, unfortunately, evidence of this.

Houses in tropical countries have often numerous large openings, and it is contended that it would be difficult to seal them, or halls, stores or markets without elaborate and expensive wooden framing. As a matter of fact, and proved this year in numerous instances in New Orleans, an intelligent workman can in an incredibly short time paper over a whole archway, hall, or even court (Figs. 25 and 26). By the use of a few supporting laths, and with stout and thin paper, the very large openings can be completely sealed. The stout paper necessary for covering large openings can usually be procured locally and at once. Paper cut in rolls three inches wide is exceedingly useful for pasting along the cracks, but would be required to be ordered and to be kept in stock. In an emergency, however, strips of newspaper could readily be cut. Although it is recommended to seal the rooms from the inside, I think there is an advantage in sealing windows, &c., from the outside, in order not to disturb any mosquitoes which may be present. If there are any fireplaces or other holes they will require to be sealed from the inside. The doorway is left open till the last to introduce the fumigating materials and to light up; when this has been done the door is brought to and sealed, and the time noted in a book kept for the purpose. The Medical Officer or the Chief Superintendent should personally examine to see that the sealing is carried out effectively. A small open chink admitting light is sufficient to attract mosquitoes to it, they then make their escape. Halls, water-closets, or outhouses must not be forgotten.

Considerable objection amongst the poorer classes is usually taken to the disturbance of their homes and their displacement by the fumigation. *No*

¹ Under Section 3 of Ordinance 14, 1902, Belize, there are the necessary powers for carrying this out.

excuse, other than severe illness in a room, should be taken as exempting any part of the house from fumigation except the sick room, which should be fumigated as soon as possible.

After the allotted time necessary to thoroughly complete the fumigation is up the doors are opened and the floor swept. Some of the mosquitoes may be only stupefied, and it is necessary that they be all burnt or otherwise destroyed.

After the patient is convalescent, or after death, the patient's room is to be fumigated.

Materials and Apparatus to be used in Fumigation, and precautions to be taken.—No guesses at the amount of material to be used are to be made, but the room should be carefully measured and materials proportioned to cubic capacity as follows (small closets and wardrobes to be opened):—

Pyrethrum powder.—3 lbs. to 1,000 cubic feet applied for three hours, and it is better that the 3 lbs. be divided amongst three pots than that all the powder be put in one pot. The pot to be placed in pans containing a little water. Pyrethrum powder is used for rooms close to the sick patient, as the fumes which might escape from sulphur fumigation are irritating.

Pyrethrum powder is also used in cases where brass work, pianos, telephones, instruments, &c., are present.

Sulphur.—2 lbs. to 1,000 cubic feet. The pots containing the sulphur are to be placed in pans containing one inch of water. The sulphur is to be started by alcohol, and care must be taken to see that it is well alight. Duration three hours. Brasswork and instruments are liable to injury, they should, therefore, be removed.

Camphor and Carbolic Acid.—The mixture consists of equal parts camphor and crystallised carbolic acid dissolved by gentle heat. It is an exceedingly good fumigator, does not injure furniture, clothes or brass work, the odour is pleasant and smells of camphor. A room has a refreshing smell after its use.

Four ounces are vapourised per 1,000 cubic feet for two hours. The material is placed in an open pan placed over a spirit or petroleum lamp, white vapour is given off.

To test the efficiency of the fumigation, it is very useful to enclose some twenty or more mosquitoes in a cigar or other small box covered on one side with muslin. The box is placed on the floor, and the mosquitoes should be dead at the end of the fumigation. They should be kept, however, to see if they revive.

Avoid risk of setting fire to the premises by using care and foresight.

Fumigation of Adjacent Houses and General Fumigation.—It is most important that the houses in the vicinity of the house in which a case of yellow fever is declared should be fumigated at once. In Belize this summer powers were sought to compel owners, or occupiers of houses, building lots, outhouses and premises situate within 100 yards of the infected house or premises to destroy all mosquitoes, larvæ, pupæ, &c. I am strongly of opinion that this is not sufficient. The householder cannot as a rule carry out fumigation as described above, it can only be carried out effectively by the proper staff which should be that of the Medical Officer of Health. The result of the householder carrying out fumigation is that the majority of the mosquitoes are not killed, that cases

of yellow fever occur in the so called fumigated houses, and that the method is brought into disrepute. I do not think that the authorities in Belize any more than in other places had realised the necessity of issuing stringent directions for the destruction of the Yellow Fever Mosquito, because in an official circular which the Health Board issued this summer it is stated :—" Inside of houses care should be taken to destroy mosquitoes as much as possible, especially if there are any cases of fever in the neighbourhood. This may be done by burning either insect powder or tobacco leaf freely in the room after closing the doors and windows; afterwards sweeping the ceilings, walls and floors, and destroying the sweepings (which will contain dead and stunned mosquitoes) by fire." This paragraph is of very little use to the householder, and it certainly will not bring about the effective destruction of mosquitoes; on the contrary, a sense of false security may ensue. Those who have worked with culicides know that the quantities of materials to be used must be specified, the sealing must be complete, and the exposure a definite time; that a little practice is necessary, and that tobacco leaves are not used because it is exceedingly difficult to fire them, that special apparatus is necessary, and that the smell penetrates everything. I therefore recommend that the District Board be given powers to execute fumigation in the houses surrounding the infected house, and that the distance be not specified, but that this be left to the discretion of the Board acting on the advice of the medical officer.

Whilst I am of opinion that the fumigation of an infected house and the houses surrounding should be carried out by the health authorities, I think that the inhabitants of the town should be encouraged to fumigate their houses in a systematic and scientific manner, and not to rely on carrying a little insect powder alight on a shovel through the rooms, which is as effective as the old native plan, still adopted in some places, of lighting bonfires in the streets. For that end I think that it would be of advantage if the District Board would undertake for a nominal fee the fumigation of houses when they were applied to. If the camphor-carbolic compound is used, householders would be distinct gainers, as moths and objectionable vermin would be killed, and there would be no damage to furniture or clothes, by either smell, smoke, smuts or corrosion.

ERADICATION OF THE *STEGOMYIA FASCIATA*.

Eradication of the *Stegomyia fasciata* underlies the action of any attempt to get rid of Yellow fever.

The problem is one which, although at first sight may appear difficult, is in reality a comparatively simple one, practicable and not costly.

5.—MOSQUITO SURVEY.

The immense mass of evidence connected with the distribution and life history of the *Stegomyia fasciata* shows that it is essentially a town or domestic mosquito. That it breeds either in the yard or in the house, that it does not breed in the swamps or to any great extent in the gutters, but that its usual breeding place is the innumerable collection of cisterns of all patterns, barrels and cans which are present in abundance in Central and

South American towns. It is a clean-water mosquito, although occasionally it may be found in dirty water, and hence it is found in the clean water receptacles to the almost complete exclusion of all other species. In Chapter III., devoted to the mosquito survey of Belize, I have shown that it is widely distributed in that town; I have found it also at the other principal ports in the Colony, and at Livingston, Puerto Barrios and Puerto Cortes, always in the same place—the clean water receptacles in the yards.

6.—SCREENING OF WATER SUPPLY.

In Chapter IV., on the water supply of Belize, I have discussed the methods which should be adopted to prevent water receptacles from becoming breeding grounds, and I am of opinion that Sections 39 to 47 Ordinance 29 of 1894, should be brought into force, with certain additions agreed to by the Committee who met the Superintendent of Public Works and myself, to discuss the matter (Ch. IV.). At the same time I feel that it would be to the public advantage, and an example which would place the Colony in the forefront of Central American sanitation, if a separate Ordinance were made to include those clauses which would deal with the screening of cisterns and the abolition of odd receptacles, wells, and other foci which might act as breeding places. Such an Ordinance to be called the "Screening Ordinance," or "The Ordinance for the Prevention of the Spread of Disease by the Destruction of Mosquitoes." The Ordinance might be framed upon that approved for New Orleans, August 2nd, 1905, and which runs as follows:—

MAJORITY OF NEW ORLEANS,
CITY HALL,
August 2nd, 1905.
Calendar No. 4,070.

NO. 3,196, NEW COUNCIL SERIES.

AN ORDINANCE prescribing the manner in which water liable to breed mosquitoes shall be stored within the limits of the City of New Orleans.

SECTION 1.—Be it ordained by the Council of the City of New Orleans that no water liable to breed mosquitoes shall be stored within the limits of the city, except under the following conditions.

SECTION 2.—Water kept in cisterns, tanks, barrels, buckets, or other containers for a period longer than one week shall be protected from mosquitoes in the following manner: Cisterns shall be covered with oil by the property owner or agent thereof, within forty-eight hours after the promulgation of this Ordinance, and provided with a cover of wood or metal; all openings in the top, or within six feet of the top, larger than one-sixteenth of an inch to be screened with netting of not less than eighteen mesh, or cheese cloth or other suitable material by the property owner or agent thereof, within forty-eight hours after the promulgation of this Ordinance, provided that after the first day of October, 1905, all property owners shall be required to screen cisterns with wire netting of the proper size mesh as required by the Board of Health, in such a manner as to prevent the entrance of mosquitoes.

SECTION 3.—Tanks or barrels, or similar containers to be constructed in the manner provided for cisterns, or in some other manner satisfactory to the Board of Health.

SECTION 4.—Buckets containing water for longer than one week (such as fire buckets in cotton presses) and other similar containers of stagnant water, shall be covered in such a manner as to prevent the entrance of mosquitoes.

SECTION 5.—Water in ponds, pools, or basins, in public or private parks, places of resort, or residences, or in depressions or excavations made for any purpose, shall be stocked with

mosquito-destroying fish, or covered with protective netting, or shall be covered with coal oil in a manner satisfactory to the Board of Health, by the owner or agent thereof, within forty-eight hours after the promulgation of this Ordinance.

SECTION 6.—The Board of Health may, in its discretion, whenever deemed necessary, treat stagnant water by applying oil to its surface in such a manner as to destroy mosquitoes.

SECTION 7.—The object and purpose of this Ordinance is declared to be the prevention of the spread of disease by the destruction of mosquitoes.

SECTION 8.—The penalty for violations of this Ordinance or any section thereof shall be a fine of not more than twenty-five dollars or imprisonment for not more than thirty days, or both, and failure to comply with any provision shall be considered a separate offence for each day of its continuance after proper notification by the Board of Health.

Adopted by the Council of the City of New Orleans, August 1, 1905.

(Signed) T. W. CAMPBELL,

Clerk of the Council.

Approved August 2, 1905.

(Signed) MARTIN BEHRMAN,

Mayor.

I do not think from observation that oiling cisterns by a Public Board is to be relied upon as a means of destroying mosquitoes. In the first place the oil is constantly washed away by the frequent rains in wet weather. In the second place objection is taken to it by many, and the cost is very considerable. As a result of oiling this summer in Belize, there could have been but very slight reduction in the *Stegomyia*, as I found them abundantly present in nearly all yards. IT IS FAR MORE EFFECTIVE TO HAVE A STANDARD FORM OF SCREENED CISTERN AND TO CONTROL IT.

Indeed, the secret of success in anti-yellow fever legislation will lie in bringing the drinking and storage water under control, and fortunately for Belize and the other ports in British Honduras this is not a difficult nor costly matter, and the security and prestige to be obtained by protected and carefully inspected water supply will far outweigh the expenditure incurred. As Reed and Carrol have pointed out, it must not be forgotten that a well drained and well governed city with a fine water supply and clean streets is no protection against yellow fever if there are rain-water receptacles breeding *Stegomyia*.

(For further details see chapter on Water Supply).

7. HARBOUR AND WHARF EXTENSIONS AND WATER SUPPLY.

It will be seen from the Pan-American Sanitary Convention, 1905 (see Chapter XI.), that very considerable distinction is made between vessels which go alongside or close to wharves and those which stand out some distance. I have also pointed out that according to the President of the Supreme Board of Health of Mexico, the wharves at Vera Cruz, constructed at great cost to facilitate trade, have practically remained useless. The reason is the danger of *Stegomyia* mosquitoes getting on board the ships. I consider, therefore, that if a wharf or jetty should be constructed at any point on the coast of British Honduras for the purpose of advancing the banana or other industry, that no water receptacles other than those approved of by the Health Authority, and screened, should be allowed within the limits of the town, or if there is no town, in any scattered houses or sheds within a radius of at least two miles from the wharf. With the growth of the banana industry and of the shipping facilities which various Central American Republics are offering, it is well to bear in mind that

the element of the mosquito has to be calculated with in the same way as in the engineering enterprise at Panama.

8. MOSQUITO NETS AND SCREENING HOUSES.

Under no circumstances should the use of the standard gauge net be omitted, sometimes a finer one may be employed to keep off the sand fly, but the net should be the invariable rule in connection with every bedstead. They should be kept in thorough repair and be ample in size, and well tucked in.

Very few houses are screened in Belize ; it is a great advantage to have one sitting room—or one portion of the verandah made secure if the whole house cannot be rendered mosquito proof. *Stegomyia fasciata* bites in the day as well as at night, and to have one or more rooms so treated that they are not invaded by *Stegomyia* or *Anopheles* is a very great comfort. Screening of the houses and verandahs has taken place on a most extensive scale in the suburbs of New Orleans, and the expense has been amply justified by the resulting comfort.

9. ANTI-MOSQUITO PROPAGANDA.

The United States and Mexico have taken a leading share in distributing literature upon the subject of mosquitoes and Yellow fever. There can be no question that as a result the public are commencing to thoroughly appreciate the problem. Were it not for the extraordinary educational movement which occurred in New Orleans this year, it would have been infinitely harder to have dealt with the situation. As it was, the churches, medical societies, corporation, business organisations, clubs, factories and schools all took part in organising lectures and spreading literature dealing with fumigation, oiling, screening and early notification. In my opinion it would be highly desirable if in some of the small elementary books which are read in the primary schools of Belize, dealing with the natural products of the country or with geography, there were inserted a chapter upon the Yellow fever and malaria mosquito, and showing how to get rid of "wiggle waggles." It is most desirable also to give lantern and practical demonstrations.

As a matter of personal observation, not only in British Honduras, but also in Guatemala and Spanish Honduras, I found the young as well as the old amongst the natives very keenly interested, and in very numerous instances quite well aware of the fact that the "wiggle waggles" in the water-butt became the mosquito. Considering the vast amount of sickness caused by mosquitoes, it is time that the children were taught how to get rid of these dangerous pests.

CHAPTER III.

MOSQUITO SURVEY OF TOWN OF BELIZE.

EXAMINATION OF THE WATER RECEPTACLES.

ON September 18th, 1905, I commenced a systematic survey of the cisterns and other receptacles containing fresh water in order to ascertain the relative number, distribution and variety of mosquitoes. The first mosquito brigade consisted of Mr. Burchell, the Superintendent of Public Works, myself, and three native assistants. On the following day, September 19th, I organised two other brigades, one under the direction of Dr. J. H. Harrison, the Assistant Colonial Surgeon, the other under that of Dr. Heusner, both of whom kindly volunteered their services; both were assisted by three natives. Each party was furnished with the necessary utensils and bottles for collecting the mosquito larvæ, with a ladder and with a special form known as "Cistern Report," which I had printed for the purpose. A return was made in this report of the kind and number of water receptacles present in each yard, whether they were screened or oiled, perfect or imperfect, whether larvæ were present or not. In a very large number of instances the adult *Stegomyia* mosquito was readily found sheltering in or near to the barrels; where this was not the case, samples of the larvæ were taken to the laboratory and allowed to develop into the mosquito, and the species then determined. The portion of the town first surveyed by Mr. Burchell and myself consisted of the poorest parts, situated to the west of the canal (the over-pond district), and reaching from the river on the north to Yarborough on the south. This portion stretched into the mangrove swamp, and very many of the compounds were under water. We found that the houses in this district had apparently been erected without any regard to building regulations, and were often placed across the projected continuation of roadways.

The number of barrels and oil tins in this neighbourhood was exceedingly high. We carefully examined no less than 578 barrels, all containing water and wrigglers. In no instance were they covered, nor had oil been put on them, at any rate in sufficient quantity to have effect on the wrigglers. In a large proportion of cases the *Stegomyia fasciata* was present. The number of tins found was still greater, and in the large majority of cases they contained water and bred mosquitoes in great abundance.

Some of the tins contained strong wood ashes solution, but we found that this had no effect in preventing the breeding of the wrigglers. We examined 177 wooden vats, and found them all unscreened, and in a large number of cases

very dilapidated, so that it would be difficult to screen them. We examined 48 old iron tanks, many of them beyond repair. There was no attempt at screening. In many instances both the vats and tanks had been oiled, but the oiling had not been carried out regularly, and our examination showed no oil on the surface at the time of examination.

We found 22 wells, many of them breeding mosquitoes, the majority, however, did not appear to be favourable breeding places. They usually contained dirty water, and were used in dry weather for washing and watering purposes. We also found a considerable number of canoes, many of which harboured mosquito larvæ.

In addition to the preceding receptacles, many of the compounds were littered with old tins, broken pitchers, bottles, calabashes, flower-pots, conch shells, and other miscellaneous water-holding débris, all of which took a share in wet weather in breeding mosquitoes.

TOTAL NUMBER OF LOTS EXAMINED.

From the 17th September to the second week in October we continued the systematic survey of the town, with the result that by October the 10th we had examined 836 *separate lots*, and of this number Mr. Burchell and myself had inspected 500. As the total number of lots, according to the plan of the town, is between 1,300 and 1,400, and as not all are occupied, it will be seen that we examined between one-half and two-thirds of all the lots, a number sufficient to furnish accurate figures of the abundance or otherwise of the *Stegomyia fasciata* in Belize.

In the following analysis I have included the total number of water receptacles examined in the 836 lots, including the barrels, the large wooden vats and iron tanks and the wells, and excluding the very numerous kerosene oil tins and odd receptacles of all kinds. The number of barrels more than doubles the number of vats and tanks put together, whilst the number of wells is comparatively small.

The Barrels.—Number examined, 1,342. Mosquito larvæ were far more numerous in the barrels than in any other form of receptacle. They were, as a rule, present in enormous numbers, and I could always find them even after heavy rains, when the barrels had in consequence overflowed for some considerable length of time. It has been stated that in the wet season the flush-out of the barrels by the overflow would get rid of the larvæ. I do not think so, as nothing short of the complete emptying of a barrel and subsequent scouring will dislodge the larvæ and eggs; furthermore, one never finds all the barrels overflowing at once.

The barrels appear to afford more favourable conditions for breeding than the other receptacles. They are deep and dark enough to give protection to the larvæ from the direct action of the sunlight, and they are not so deep that the larvæ cannot readily seek the bottom for shelter when disturbed; the temperature of the water is also probably more favourable.

The Kerosene Tins.—Number very great, not counted. Where the tins were in constant use I did not find larvæ; where, however, the tins were

discarded or where the water was not renewed often enough, larvæ were present in abundance. In the poorer houses tins were often found containing a strong solution of wood ashes for washing purposes ; in these larvæ could usually be found.

The Wooden Vats.—Number examined, 489. I found larvæ present in a large number of the vats. It is often, however, difficult to find them at first. The top of the vat has to be reached with a ladder and the lid disturbed, the result is that the larvæ disappear, and the impression is given that there are no larvæ present. In these cases I have sometimes found them by drawing off the water by the tap at the bottom of the vat. They probably all contain larvæ, but not in such abundance in proportion to size as the barrels.

The Iron Tanks.—Number examined, 271. Owing to the smallness of the lid it was difficult to make a thorough examination of these receptacles. Larvæ were present in many, but not in such abundance as in the wooden vats, the iron rust in the water may have some effect, but in all probability only very slight.

The Wells.—Number examined, 91. The well water is within a few inches of the surface of the sodden ground, and is as a rule dirty and often decomposing from the presence of vegetable and animal matter. In a large number larvæ were present, in a few they were absent, which I attributed to the effect of recent oiling.

The Effect of Oiling the Receptacles.—In the examination of this large series of receptacles I could not detect an appreciable diminution of larvæ from the oiling, which had come into force since June, due, no doubt, to the fact that the frequent rain washes the oil out in those cases where it has been used ; moreover, it was obvious that it was not applied often enough, or in sufficient quantity, and then only in a certain number of receptacles.

2.—SPECIES OF LARVÆ PRESENT IN THE WATER RECEPTACLES.

In all clear-water receptacles the larvæ of the *Stegomyia fasciata* were far in excess of all other kinds. On approaching the barrels silently, the characteristically banded mosquito could usually be found sheltering on the staves. The larvæ could also often be distinguished, but in the majority of cases samples of the larvæ were taken to the laboratory to develop, and with few exceptions they yielded the characteristic mosquitoes. Culicidæ were not numerous in the clear-water receptacles, they made their appearance in large numbers only when the water was very dirty and decomposing.

The following figures show the proportion of the *Stegomyia* in the receptacles. In the 500 lots examined by Mr. Burchell and myself I found the *Stegomyia* present as follows :—

- In first 100 lots, 19 times.
- In second 100 lots, 44 times.
- In third 100 lots, 38 times.
- In fourth 100 lots, 26 times.
- In fifth 100 lots, 35 times.

or in the 500 lots in the proportion of 3·34 per cent.

In the 164 lots examined by Dr. Heusner the *Stegomyia* was found 82 times, or in 50 per cent., and in the 172 lots examined by Dr. Harrison,

19 times, or in 11 per cent. of the lots. When it is remembered that not all of the numerous samples which we brought to the laboratory ever developed into the complete mosquito, I think I am safe in concluding that the *Stegomyia* was present at least in 50 per cent. of the lots in the town. In the very numerous series of receptacles which were examined, in no instance were the larvæ of the *Anopheles* found.

3.—EXAMINATION OF THE GUTTERS AND POOLS.

Having ascertained that the clear-water receptacles in the town of Belize contained the *Stegomyia fasciata* in very large numbers, I next examined the shallow weed-grown gutters and the deeper canals along the streets, together with the pools in the waste places and the swamps. (See plates VII. and VIII.)

As will be shown in a later portion of this report, the gutters contained with few exceptions clear or only muddy water, not to any large extent the sewage commonly met with in other towns. They contain, on the other hand, abundant aquatic weeds, and support immense numbers of tadpoles and minute fish. The canals by the side of the roadways are lined with "sour grass" and other weeds, and extend into the mangrove swamps; they, in fact, constitute prolongations of the swamp into the town. There is a sluggish circulation in them which is increased at the time of high tides. They receive a very large proportion of the night soil, but as they are fortunately so well stocked with the scavenger cat-fish, other specimens of fish, tadpoles and crabs, everything in the nature of animal offal is usually readily consumed.

In none of these places were either my colleague or myself able to find the larvæ of *Stegomyia*, whilst larvæ of Culicidæ were rare. The larvæ which usually were to be found to the exclusion of all others were those of the *Anopheles*. These larvæ were, however, more abundant in the clear, comparatively shallow, weed-grown pools or gutters than along the sides of the canals and the fringe of the mangrove swamps.

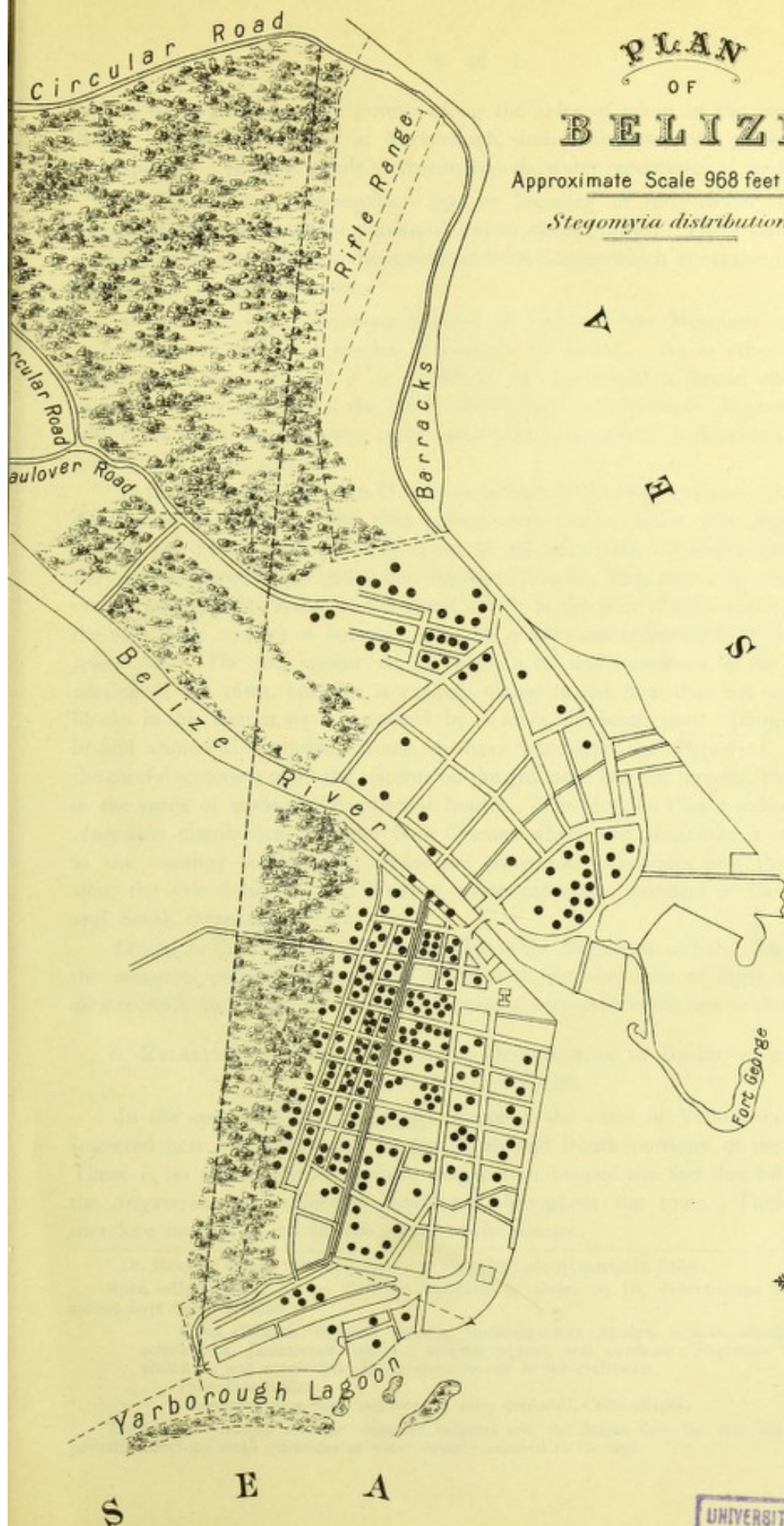
4.—EXAMINATION OF THE CRAB-HOLES.

A feature of the low lying parts of the Colony are the innumerable crabs which everywhere are to be found burrowing in the sandy soil of the streets, yards and gardens, and beneath the houses. The holes are comparatively shallow, but, nevertheless, are deep enough to reach the water level. These holes harbour the crab-hole mosquito or *Deinocerites cancer* in large numbers, occasionally other species are present, but I did not find *Stegomyia* nor *Anopheles*. After heavy rains they become troublesome, as the water fills their holes and they take shelter in the houses. Apart from the discomfort which they may give rise to, they are harmless.

5.—SUMMARY OF THE MOSQUITO DISTRIBUTION IN BELIZE.

The mosquitoes found in the town of Belize may from the habitats of the larvæ be divided into three groups.

1. *Anophelina*.—*Cellia albipes* and another undetermined species breeding in large numbers in and around the town. Especially abundant at the north end in the marsh land around the Barracks, in private residences and at Quarantine Station. Along the fringe of the mangrove swamp surrounding the town to the back



PLAN OF

BELIZE

Approximate Scale 968 feet = 1 inch.

Stegomyia distribution •

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In the shallow weed-grown gutters along the sides of many of the streets of Belize. In the marsh land at Yarbrough, and in shallow pools generally in waste places. In cattle ponds. Absent from the water receptacles of the houses.

2. *Culicina and Aedeomyia*.—Species breeding in dirty water, in odd receptacles, and barrels in the yards and in some of the gutters. The *Deinocerites* cancer, as just mentioned, in the innumerable crab-holes which infest the grounds beneath and around the houses

3. *Culicina*.—The *Stegomyia fasciata*, or Yellow Fever Mosquito, appears to be the most abundant species of mosquito in Belize. As in other towns where it has been studied it is found to be essentially a house mosquito, breeding in the cisterns in the yards and living in the houses. It prefers the still, clean water, and therefore seeks out the cisterns, where it flourishes to the exclusion of other species.

In the accompanying Plan II. I have indicated the *Stegomyia* and *Anopheles* distribution in Belize. The dots indicate the blocks where the *Stegomyia fasciata* has been found either by myself or my colleagues. It will be seen that they are distributed throughout the inhabited blocks; they are very abundant on the swamp side (West) of the canal, which is the poor district, and contains the very large number of barrels. *No area of the town examined by us has been found free.* The foci appear on the plan to be less numerous in the North portion of the town, but this is entirely owing to the fact that not so many blocks in this district were examined by us as in the South part. Immediately in and around Government House we have not found the *Stegomyia*, due to the careful screening of all the cisterns on the grounds; but it is present, however, in the yards of some of the adjacent houses. The dots on Plan 2 indicate the *Anopheles* distribution. Unlike New Orleans where the *Anopheles* is confined to the swampy outskirts, in Belize the *Anopheles* penetrates into the town along the side drains; it is, however, more especially abundant at the North and South extremities of the town.

Owing to the very selective distribution of the *Stegomyia* and the *Anopheles*, the measures which must be taken in order to free the town of these pests is at once made clear, and the problem becomes a very practicable one to deal with.

6. RELATIONSHIP OF THE STEGOMYIA DISTRIBUTION IN BELIZE TO THE CASES OF YELLOW FEVER.

In the spot plan accompanying Chapter I. the cases of Yellow fever are scattered here and there both in the North and South portions of the town. There is no special feature in their distribution beyond the fact that we know the *Stegomyia* was uniformly distributed throughout the town. There was therefore nothing to hinder the spread of the disease.

¹ Dr. Heusner regards this latter species as the chief malarial carrier in Belize.

NOTE.—Upon some of the Culicidæ identified in Belize by Dr. Heusner the following species have been recorded:—

Culex albitarsis, *restuans*, *serratus*, *taeniorhynchus*, *atratus*, *senatus*, *alboannulatus*, *scholasticus*, *Jamaicensis*, *marinus*, *fatigans*, *pipiens*, and *confinnis*; *Stegomyia fasciata*, *scutellaris* and *notoscripta*; *Deinocerites cancer* in the crab-holes

Panoplitis titillans.

Anopheles niggerimus and *sinensis* (very doubtful), *Celia albipes*.

The natural enemies are the minnows, tadpoles and the dragon fly: the sun has also a powerful effect on small quantities of water directly exposed to its rays.

CHAPTER IV.

WATER SUPPLY OF THE TOWN OF BELIZE.

THE sources of supply consist for the most part of rain water, well water being used to a very limited extent for washing purposes, watering cattle and gardens. The drinking water is almost wholly furnished by rain water and is collected in various receptacles, amongst which the following are most frequently encountered.

Vats.—The regular cistern consists of a very large wooden vat holding some 2,000 gallons and covered with a loose fitting lid raised a few inches above the level of the top of the vat to allow of aeration. The rain-water from the roof is conducted to the cistern by means of a gutter of variable length. In some instances there is an overflow pipe, but more usually the cistern overflows at the rim when full. The cisterns are the same as used in the Southern States, and are obtained from New Orleans and Mobile. (See figures 5, 6, 24.)

Many of them are in considerable disrepair, the lids being broken and the upper ends of the staves warped and separated from one another. Many of them also contain a very considerable sediment made up of leaves, fruits, and remains of animal matter.

Dr. Harrison, Assistant Colonial Surgeon, is of opinion, from his examination of the lots throughout the town, that not 50 per cent. of the population are provided with vats. In our examination we found that in 836 lots there were present 489 wooden vats and 271 large iron tanks—figures which bear out Dr. Harrison's experience, as many lots had two or more tanks or vats.

There are 18 public vats with a storage capacity of 1,869,848 gallons.

Tanks.—In our inspection of 836 lots we found large iron tanks present 271 times, that is, they are about half as numerous as the wooden vats. Their capacity varies, an approximate estimate is about 500 gallons for wrought iron and 1,000 gallons for cast iron.

The lid of the iron tank is very much smaller than in the case of the wooden vat, and simply consists of a manhole. We found them unscreened and containing much débris. A very considerable proportion of the wrought-iron tanks had fallen into absolute decay and were perforated with numerous holes. In our examination they appeared to us to contain less larvæ than the wooden cisterns. I think, however, that they are more objectionable in many respects than the wooden cistern. They are very difficult to mend, and when worn out, unless broken up, they will harbour larvæ. In certain instances the cast-iron vats were covered with wooden and some with corrugated iron roofs. These, we found, contained a considerable amount of decaying animal matter.

Wells.—There is a limited number of wells in the town. There are public wells which are used for washing purposes, washing horses, and for purposes of fire. They are not screened. In addition to these we found 91 small shallow wells in the 836 lots which we examined consisting merely of a hole or of a barrel sunk in the ground. They are not covered, the water in them is dirty and

used for watering and washing purposes, especially in dry weather ; many of them breed mosquitoes.

Wells in any tropical town are liable to become a source of danger. If from drought the rain-water gives out, there is always a great temptation to drink the well water. The Acting Medical Officer for Belize for the year 1892, Dr. Gahne, stated then that the history of the drinking of well water in Belize had been the history of the periodical outbreak of diarrhœa and dysentery whenever the supply of rain water had run short. In the back of the town with the ground water within a few inches of the surface, and the soil liable to contamination with excreta by the overflow of the canals at the side of the roadways and of the swamps, the shallow wells in the exceedingly porous soil must become contaminated. When, in addition, it is considered that they are few in number and of exceedingly small use in cases of fire, no time should be wasted in getting rid of them. Any hardship which might be experienced if they were abolished amongst the poorer classes could be met with by the establishment of additional public vats, or possibly by erecting one or more public washhouses. An examination of the Medical Officer of Health's return shows that there is considerable mortality from intestinal affections, including dysentery, and that after malaria this group of diseases claims the most victims.

Barrels.—The barrels are certainly twice as numerous as the regular water vats and tanks. They consist of the converted kerosene oil and pork barrels. The water in them is used both for washing and also to a large extent for drinking purposes. They have no lids, and they catch the water from the roofs usually by means of old gutters, planks, or sheets of corrugated iron. (Figs. 1, 2, 3.)

We counted 1,342 in the 836 lots which we examined. They are each capable of holding some 40 gallons, and they are the most plentiful suppliers of the *Stegomyia fasciata* in the town.

Oil Tins.—In the poorer districts, and in almost every compound there is to be found a collection of kerosene tins of an average capacity of 8 imperial gallons. They are used by the inhabitants for storing water, and like the barrels they harbour large quantities of larvæ. In addition to the tins regularly used for storing water there is usually to be seen a large number of them discarded and lying about the compound. They contain a little water, and larvæ are very frequently found in them. (See Figs. 1, 2, &c.)

Odd Receptacles.—Waste water is frequently found in old bottles, paint tins, conch shells, wooden bowls, calabashes, &c. They serve to increase the number of breeding places in wet weather.

Canoes.—There is a very large number of canoes in the town, and these are frequently found drawn up in the compounds. Some of them are in good repair, but a large number are disused. We found wrigglers in them in several instances. (Fig. 11.)

In wet weather the lily tubs and other receptacles in which flowers are planted very frequently harbour wrigglers. I found larvæ of *Stegomyia* in great abundance in the cooling water barrel by the furnace in a blacksmith's shop, a similar find was made in New Orleans in September of this year.

Having, with Mr. Burchell, carefully examined 500 lots in Belize containing amongst them 280 vats, 132 tanks, 51 wells, 963 barrels, and numerous tins and odd receptacles, and having proved (see Chapter on Mosquito survey) that they

harboured in enormous numbers the larvæ of the *Stegomyia fasciata*, that they were with few exceptions unscreened, and very many in bad repair, and, further, having failed to find the *Stegomyia* in the gutters of the streets or in the marshes, I am of opinion that legislation is urgently needed to provide a properly protected water supply in order to preserve the town from another outbreak of yellow fever. The life history of the *Stegomyia* is now well known—it is essentially a cistern breeder. From the splendid success which has resulted to New Orleans from immediate rigorous screening, no time should be lost in protecting Belize, especially at a time when we know that yellow fever is present in the adjacent Republics, and that there is constant commercial intercourse between them and ourselves.

The Colonial Surgeon and the Assistant Colonial Surgeon in Belize have already drawn attention to the necessity of legislation to deal effectively with the water supply.

In the year 1894 sections 39 to 47 of Ordinance No. 29 were passed by the Legislative Council on the 7th day of June, and assented to on the same day, in Her Majesty's name, by Sir Alfred Maloney, Governor, and were brought into operation on the 1st July, 1895, by Proclamation dated 29th June, 1895. They read as follows :—

WATER SUPPLY.

39. The owner of every house in process of building on the 1st day of July, 1894, or built after that date in the towns of Belize, Corosal and Orange Walk shall erect in connection therewith, and maintain in good order, a tank or tanks for the storage of rain water and capable of holding at least the quantity hereinafter referred to as the "prescribed quantity."

40. It shall be lawful for the Central Board of Health from time to time, by notification in *Gazette*, to declare that sections 39 to 44 of the Ordinance shall be applicable to any other town or place, and the owner of every house in process of building on the ninetieth day after the date of such notification, or built at any time thereafter in such town or place, shall erect in connection with such house a tank or tanks for the storage of rain water, and capable of holding at least the quantity of water hereinafter referred to as the "prescribed quantity."

41. It shall be lawful for the Central Board from time to time to direct, by notification in *Gazette*, what shall be the prescribed quantity for houses in any town or place, and when made, to revoke and alter such direction; and while any such direction remains in force the quantity specified in such direction shall be the prescribed quantity. Until otherwise directed by the Central Board of Health the prescribed quantity for the towns of Belize, Corosal, and Orange Walk shall be five imperial gallons for every square foot of flooring in each house, exclusive of any verandahs attached thereto.

42. No tank required to be maintained under the provisions of this Ordinance shall be deemed to be in good order—

(1.) If it is not connected by pipes to gutters attached to a roof or platform exposed to the weather.

(2.) If such gutters or pipes are not of sufficient size to receive all the rain falling on such roof or platform and to convey the same to the tank, or if such gutters or pipes are not in good order; or

(3.) If the tank is not fitted with apparatus for drawing off water therefrom without waste; or

(4.) If the tank is not kept covered; or

(5.) If the tank is not watertight.

43. Each owner of any house required by this Ordinance to erect and maintain a tank, who fails to erect a tank capable of storing the prescribed quantity of water, or who fails to maintain such tank in good order, shall be liable to a penalty not exceeding two cents for each gallon of the prescribed quantity of water for which he was bound to provide storage, and to a further penalty not exceeding five dollars for each day during which such failure shall continue after conviction.

ERRATUM.

For "sections 32 to 44" read "sections 39 to 44."

44. When there has been any failure to erect or maintain any tank required by this Ordinance to be erected or maintained, and where proceedings have been or are to be instituted for recovery of any penalty for such failure, the Local Board of the district within which such building is situated may, by written notice, require the owner within a reasonable time therein specified to erect a tank capable of holding the prescribed quantity, or to do such work as may be necessary to put the tank in good order; and if such notice is not complied with, the Local Board may, at the expiration of the time specified in the notice, erect such tank, or do the work specified in such notice, and may recover in a summary manner the expenses incurred by them in so doing, or may by order declare the same to be private improvement expenses.

45. Every Local Board may, and when required by the Central Board shall, construct and maintain tanks and reservoirs for the storage of rain or fresh water as may be necessary, and may sell all the water so stored, or permit the free use thereof.

46. Every Local Board may make bye-laws for regulating the issue of water from any tank or reservoir under their charge.

47. Every person who wilfully fouls any water in a tank or reservoir, or who wilfully wastes any water stored in a tank or reservoir, or who wilfully damages any tank or reservoir, or any guttering, pipe, cover, platform, roof, tap or pump connected therewith, shall be liable on summary conviction to a penalty not exceeding fifty dollars; and shall in addition be liable to pay to the person aggrieved such sum, not exceeding one hundred dollars, by way of compensation for such fouling or wasting such water, as the Court may consider adequate, and in the case of damage to pay to such person the cost of repairing the same, and such cost shall be ascertained and determined by such Court.

Unfortunately, by an Ordinance (No. 22 of 1899) sections 32 to 44 were repealed, and thus a most wise measure, as subsequent events have amply proved, was cancelled.

Early in May of this year, Dr. Harrison, acting as Medical Officer of Health for Belize, drew attention to the inadequate water supply, and to the fact, since corroborated by Mr. Burchell and myself, that 50 per cent. of the population were not supplied with proper vats, and that, in consequence, odd receptacles were used. The Medical Officer of Health added "that if it were not for the fact that a goodly number of the population rely on the generosity of householders to give them water, also that a fair quantity is sold by private persons, the storage as it stands just now would be a failure." The requirements of the inhabitants of Belize are fortunately not much as regards water, there are no manufactories nor water-closets to flush, so that a supply of 10 gallons per head per diem would, it is stated, suffice, and with the rainfall of Belize, it is practicable to procure such a quantity during a very considerable portion of the year.

After the outbreak, Mr. Burchell, the Superintendent of Public Works, who arrived in the Colony on July 31st of this year, made an examination of the sanitary condition of the town of Belize, and drew up a report upon the preliminary measures which appeared to him to be desirable. He urged—in addition to the cleaning of brush and opening of drains and canals, the continuation of the extermination of the mosquito, the screening of tanks, removal and destruction of pots and odd receptacles which would afford breeding places—that the poorer people be provided (a) with barrel covers with a hole in the centre for the admission of water covered with suitable gauze: (b) cheap wood spigots to insert in each barrel for drawing off water without removing the cover. This recommendation, amongst others, was finally passed, and the Legislative Council voted a certain sum with which to carry them out.

Action upon these recommendations was, however, deferred until I had arrived in Belize and had an opportunity of myself making an examination

of the sanitary condition of the town. Immediately on my arrival, September 18th, I set about a systematic examination of the "Lots," together with Mr. Burchell, whose assistance was of the greatest importance. As a result of this preliminary joint survey, which included an inspection of 345 lots and an examination of 643 barrels, 173 vats, 79 iron tanks and 30 wells, we drew up an additional emergency joint memorandum—the paragraph dealing with the water reading as follows :—

Paragraph 11.—Yards may contain :—

- | | |
|-----------------|-------------------------------------|
| 1. Wooden vats. | 4. Tin receptacles. |
| 2. Iron tanks. | 5. Jars, tins, bottles, and doreys. |
| 3. Barrels. | 6. Wells. |

At the present time, with a very few individual exceptions, these are not screened in any way and breed mosquitoes in great numbers. The number of barrels and tins is very large.

The tins should be abolished. The barrels should at once be covered with cheese cloth, nailed on, and a spigot inserted.

In the case of barrels where movable spouts are used, battens must be nailed on the top of the barrel to protect the screen, and damaged screens must be immediately repaired. The iron tanks must be protected at the inlet with copper wire gauze of at least 18 meshes to the inch properly fixed in position. The wells should be filled in.

All the worn-out and holed iron tanks to be at once removed from premises and destroyed.

All the wooden vats to be permanently screened with copper gauze so as to render exit or entry of the mosquito impossible.

The overflow to be protected with a permanent screen of copper gauze.

The intake pipes to be screened in a similar manner.

All odd receptacles such as jars, broken crockery, condensed milk tins and rubbish, which form receptacles for water, to be at once burned or removed.

All doreys, good or discarded, when in compounds, should be placed keel up.

On September 25th Mr. Burchell and myself met the District Board and usefully discussed the various items in the above paragraph. We drew the attention of the Board to the fact that the Yellow Fever Mosquito was breeding in large numbers in the water receptacles, that the oiling was inefficient, and that numerous odd receptacles and much rubbish was to be found in many of the yards. We urged the importance of at once proceeding with regulations dealing with the control and protection of the water supply, pointing out that it was imperative to devise practical measures for screening the water supply with a view of protecting against yellow fever, that the storage of water be reduced to a system as simple as possible, and that miscellaneous means of storage be done away with.

A second meeting took place on October 2nd between Mr. Burchell and myself, and a representative Committee of business men, to discuss with us certain features of the water supply problem. The water supply Ordinance (No. 29 of 1894) was made the basis for the discussion, and the following series of resolutions were unanimously agreed to by those who had met to discuss the question with us :—

(A.) That a pipe system is the best solution of the question of water supply for Belize, but failing that being obtained at a reasonable cost, the Committee would have to take up the question of some other means of supply.

(B.) That failing a pipe system, the Committee believe a system of supply by tanks or cisterns is best.

(C.) That the owner of every building used primarily as a dwelling house

shall be compelled to provide a tank or tanks, and that a clause be put in the amending Ordinance defining the words " dwelling house."

(D.) That the tanks be of such capacity as to hold $1\frac{1}{2}$ gallons per square foot of inhabited floor, but that in no case a tank be of less capacity than 800 imperial gallons.

(E.) That the principles of Sections 112 and 113 of Ordinance 29 of 1894 be applied to water supply.*

(F.) That it shall be lawful for the Local Board of Health to utilize the roof of any building, not used as a dwelling, so as to serve as a collecting area for rain water.

Provided that if a tank of 5,000 gallons capacity be used by the owners in connection with such roof the Local Board of Health shall have no right to such use.

(G.) That no tank required to be maintained under the provisions of this Ordinance shall be deemed to be in good order—

(1.) If it is not connected by pipes to gutters attached to a roof or platform exposed to the weather ;

(2.) If such gutters or pipes are not of sufficient size to receive all the rain falling on such roof or platform, and to convey the same to the tank, or if such gutters or pipes are not in good order ; or

(3.) If the tank is not fitted with apparatus for drawing off water therefrom without waste ; or

(4.) If the tank is not kept covered ; or

(5.) If the tank is not watertight ;

(6.) If the tank is not effectively screened from mosquitoes according to Ordinance.

(7.) If the tank is not provided with suitable opening for conveniently inspecting and repairing inlet and outlet and cleaning.

(J.) By *screening* is meant placing across all openings, including outlet and inlet, a wire gauze, not coarser than 18 wires to the inch both ways, of perforated metal, whose opening shall not be greater than the openings of the above specified gauze, and this material shall be so applied to the openings as to prevent the passage of mosquitoes.

(K.) That " tank " means any receptacles for the storage of rain water made of wood, iron, brick, stone or concrete, the capacity of which shall not be less than 400 imperial gallons.

* Sections 112 and 113. The Central Board of Health and every Local Board may if they think fit—

(1.) Perform any work which by this Ordinance the owner or occupier of any property is or may be required to perform.

(2.) Perform any work which the *owner* requests should be done, and which is necessary to place the property in a proper sanitary condition, " and which he shall have failed to perform in accordance with the provisions hereof. (Ordinance No. 7 of 1895, Section 2), and declare the expenses expended or incurred by them in so doing to be "private improvement expenses."

113. Where the Central Board or a Local Board have incurred or become liable for any expenses which, by this or by any other Ordinance now or hereafter to be in force, may be declared to be private improvement expenses, such Board shall thereby acquire a charge or lien on the property in respect of which the expenses have been incurred for all sums advanced with interest thereon at the rate of *six per centum per annum*.

It shall not be necessary to record such charge or lien, and the same shall continue in full force and effect until payment shall have been made of the whole sum due and of all interest thereon.

(L.) That it shall be unlawful, after a date to be specified, to keep on any premises any can, tub, bucket, barrel, or trough or other receptacle for water unless the same shall be emptied and cleaned every day.

(M.) That, in the opinion of this Committee, the closure of the wells should not be ordered until sufficient water supply is provided to meet the requirements; and that such a supply of good water is better than the water obtainable from wells sunk in the ground; and that in the meantime the wells be properly covered.

(N.) That, after a day to be specified, no wells sunk in the ground shall be kept on any premises unless properly lined, covered, screened, and provided with a pump to the satisfaction of the Board.

With regard to these unanimous opinions of the representative citizens who met us, we made it our first duty to enquire into the practicability of a pipe system of water supply for Belize. The advantages of such a system are very great, and I have already reported upon the benefits which it has conferred upon Conakry, in the French Guinea; it is the most radical way of dealing with the problem, provided that the system is well looked after and *rigidly controlled*, otherwise there is waste and formation of puddles. The source of supply mentioned as the most suitable one was the Sibun River at a point called "Butchers," about 20 miles distant from the mouth of the river and 18 miles from Belize in a straight line. Mr. Burchell and myself examined this part of the river, and a report upon the site will be furnished by Mr. Burchell. The result, however, is to show that the cost would be very great, owing to the necessity for filtration, settling tanks, and length of pipe line; in all probability the same system of filtration as proposed for the Mississippi water supply of New Orleans would be necessary, on account of the fine mud also present in suspension in the Sibun. As the Colony grows in importance, it may be that it would be in a position to undertake a pipe line; but in the meantime it is practicable to ensure a good rain water supply at once at a very much smaller cost.

Rain Water Supply.—From a sanitary standpoint, cistern-stored rain water must have in many tropical towns great advantages over well water or river water unless both the latter are well filtered or taken from an uncontaminated source. Towns supplied with rain water have been noted to be freer from intestinal infectious diseases than those supplied with well or river water. As, moreover, the necessity for effective screening of cisterns has become imperative on account of mosquitoes, an immense improvement in the rain water will take place as the screening will keep out the leaves and small animals which formerly gained ready access and polluted the water. Provided that the cisterns are carefully inspected, screened and constructed according to the rules of the health authority, raised from the ground to avoid contamination from the dirt, and the roofs and the gutters looked after and kept clean, there can be very little risk from infection from typhoid, cholera or dysentery on the one hand, or on the other hand from the breeding of the *Stegomyia*. As I have mentioned previously the water requirements are not great; there are, fortunately, neither ash-pits, dry or water-flushed closets, nor are there factories requiring water on a large scale, with the exception of one ice factory. The roofs of the houses are not thatched, and therefore the vat system, which at present is only used by some 50 per cent. of the inhabitants, can be extended. I have noticed that the vat

water is carefully looked after in the sense that no waste is allowed. There is a distinct advantage in a tropical town of not encouraging water waste; if there is leakage, slop-water gullies and drains multiply, and they soon begin to fill up with decomposing foul-smelling water.

When the conditions existing in the towns of Corosal, Orange Walk, Stann Creek and Punta Gorda, and elsewhere in the country, are compared with those in Belize, it is seen that thatched cottages predominate over zinc or other solid roofs. A thatched roof is not a good collecting surface, and the water derived from it cannot be as good as that obtained from a zinc roof; it is darker in colour, has a flavour, and is much more liable to organic pollution. In those places, however, brook or river water supplements the supply for washing purposes, and as a rule all that is essential is that *more provision be made for public storage vats under proper control.*

When in 1899 the discussion on the repeal of the water clauses 39 to 47 of the 1894 Ordinance were discussed, the Special Committee then appointed to examine the practicability of the clauses stated that the majority of houses had proper tanks and that the District Board and the Churches had sufficient storage for the remainder. They stated that the Ordinance would act against the poor, and probably be found impracticable, and finally that the measure was unnecessary under present circumstances.

The Corosal District Board stated that the owners of thatched houses should not be compelled to erect vats. Things have changed since this report, *a controlled and protected water supply is now an absolute necessity before any town in the Yellow Fever Zone can be said to be secure, and especially before a Colony like British Honduras, hemmed in by countries where yellow fever is endemic, can be declared safe.*

If the vats were adequate in Belize in 1899 they are now very inadequate, and a crop of barrels and miscellaneous receptacles have grown up and largely supplemented them, and have been the means of breeding the *Stegomyia fasciata* on a vast scale. It is imperative that a new Water Storage and Screening Ordinance, on the lines suggested by the Committee which met us, should at once be proceeded with and put into operation as soon as possible. In the meantime, a serious responsibility rests upon the community. Only a fraction of the vats are screened, the oiling is not sufficient and does not appear efficacious, and is objected to by a large number, and there is a very great number of barrels which have not been touched.

A Screening Ordinance should be introduced at once, and the vats or tanks screened permanently with the wire gauze, or, pending the arrival of suitable permanent material, with cheese cloth, the barrels also to be covered with cheese cloth until they are replaced by vats.

An outbreak of yellow fever has passed through Belize; to-day (November) the water supply is as vulnerable as it was previous to the epidemic, and still furnishes an immense *Stegomyia* breeding-ground.

CHAPTER V.

GENERAL SANITATION OF THE TOWN OF BELIZE.

DRAINAGE OF BELIZE AND ANTI-MALARIAL PROPHYLAXIS.

WITH the drainage of Belize is intimately associated the diminution of malaria and the purification of the soil. As the photographs which illustrate this chapter show, a considerable portion of the town is submerged, with resulting discomfort, dirt, and want of ready means of access for inspecting purposes. (Figs. 7-12.)

It is not my purpose to enter into a subject which will be fully and technically dealt with by the Superintendent of Public Works, but there are aspects of the drainage of Belize which profoundly affect the health of the community, and which require investigation. I refer to the following:—

1. Shallow drains running alongside many of the principal streets.
2. Depressed and water-soaked waste areas in the town.
3. Waterlogged and submerged lots.
4. Deep ditches alongside certain roadways.

1. *Shallow Roadside Drains.*—Belize is very low-lying, the soil is porous, and the ground-water stands very high. Rain rapidly soaks through the thin porous crust. At the side of a considerable number of the larger and shorter streets, shallow road drains have been made. (Figs. 13-16.) Upon a few of these much energy is spent in keeping the weeds from choking them; nevertheless, the greater proportion were weed-grown when I examined them. The drains are shallow, and in dry weather would contain no water; the water which is present is for the most part clear. I examined a very large number of them for larvæ, and found the *Anopheles* predominating—this was especially so to the west of the canal, at the rear of Government House, and at the North of the town. The places are indicated on the mosquito plan.

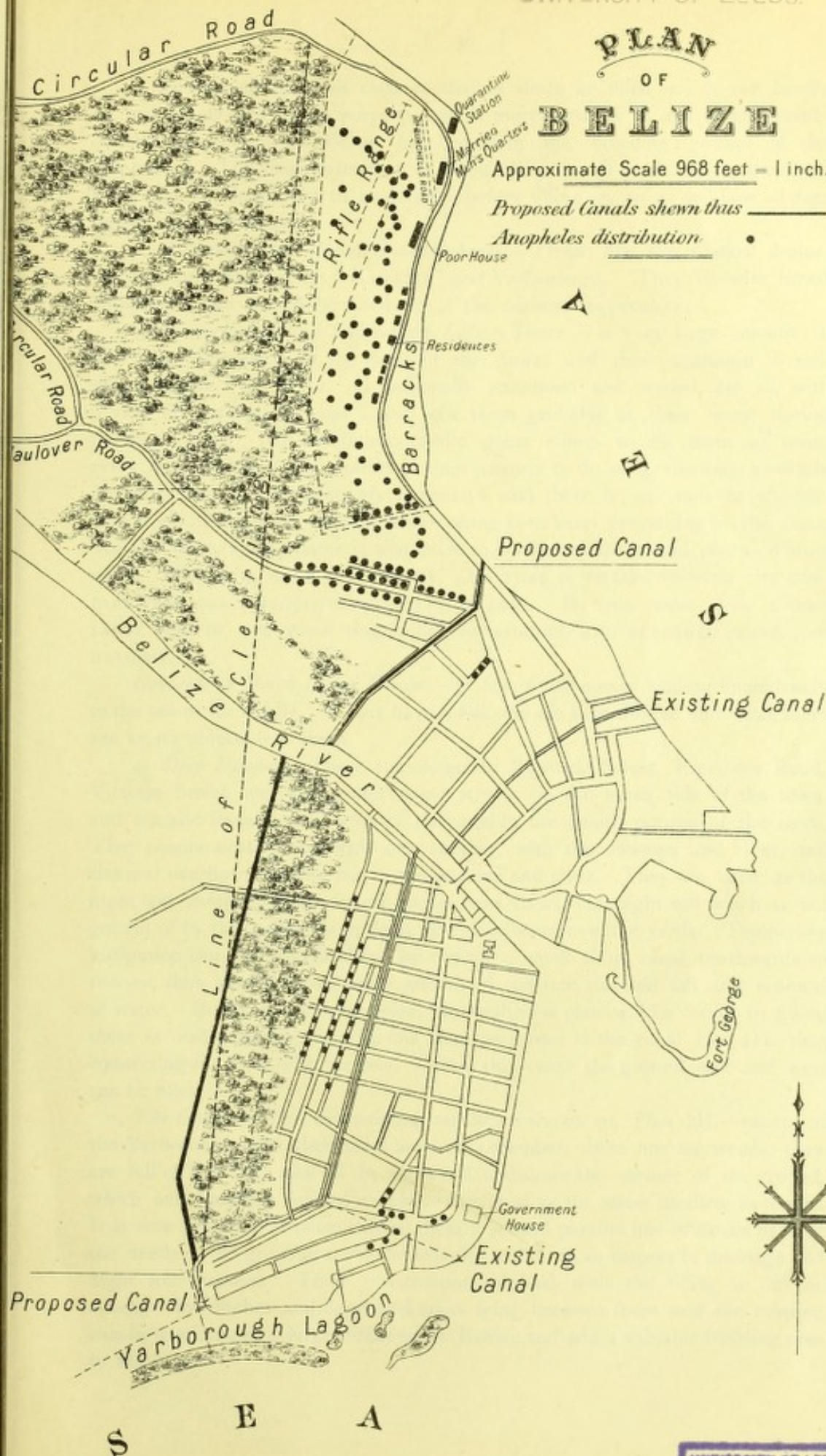
Owing to the very high level of the ground-water in certain seasons the water in the shallow side drains may be taken to represent in many instances the ground-water level. In other words, they are long shallow artificial puddles in a water-soaked soil. During a heavy rain, if the centre of the road is graded towards them they take off the rush and pass it slowly along. When the rain has ceased, owing to their exceedingly small fall, and to the innumerable weeds which act as a sponge, the water remains and the larvæ breed. In very many cases, however, they do not even serve to take the water from the roadway, as, owing to their being periodically raked, the detritus and sand which is removed is left on the side of the roadway, and the latter becomes itself gradually converted into a shallow drain.

PLAN
OF
BELIZE

Approximate Scale 968 feet = 1 inch.

Proposed Canals shewn thus ———

Anopheles distribution •



I recommend that this class of shallow drain be filled in; it can hardly be said to serve a useful purpose, and it most certainly is one of the fruitful causes of malaria in Belize by becoming the breeding ground of the *Anopheles*. The Superintendent of Public Works will in his report show how these shallow drains are to be treated before filling in, so as to allow of free underground drainage.

2. *Depressed and Water-Soaked Areas*.—These, like the shallow drains, are numerous both by the "Barracks" and Yarborough. They likewise breed *Anopheles*, and should be filled up at the earliest opportunity.

3. *Waterlogged and Submerged Lots*.—There is a very large amount of this class of property in the back of the town, and their condition is well shown in the Figs. 7-12. I personally examined and waded into all, with a very few exceptions, and I also saw them probably at their worst during the high tides. The inhabitants make great efforts to fill them up, using every conceivable waste product in their attempt to do so, as the only available dredged sand is comparatively expensive, and there is no stone or shingle. The result of the water flooding and soaking is to keep everything in the yards wet and dirty, fecal matter is also liable to be floated about, and pollution must result. THERE IS ONLY ONE REMEDY, AND THAT IS FILLING UP WITH THE COMPARATIVELY SMALL REQUISITE QUANTITY OF SAND. IF THIS WERE DONE A VERY LARGE PART OF THE TOWN WOULD BE TRANSFORMED AND RENDERED CLEAN AND HEALTHY.

Concrete or Brick Lined Drains.—A few of these exist leading immediately to the sea or the canals. If they have a fall, and are kept flushed and clean, there can be no objection to them.

4. *Deep Ditches*.—These run alongside Pigstock Street, Freetown Road, Victoria Street, and some intervening streets on the north side of the town, and are also found to the west of the canal in the South portion of the town. They communicate freely with one another, with the swamps and river, and rise and overflow with the rise in the swamps and river. They are used as the night soil dumping places for all houses near them, and night soil which is not got rid of by the cat-fish is in flood time distributed over the yards. Temporary mitigation can be brought about by cutting a small short canal northwards to the sea, thus admitting sea water and more constant rise and fall and renewal of water. In my opinion, however, the healthiest plan will be found in filling them in and replacing them by one canal as shown in the canal Plan III., thus connecting the river with the sea. Given this canal, the ground east and west can be filled in.

The Canals.—The two existing canals are shown on Plan III.—except at the Yarborough end; their sides are well cemented, there are no weeds, they are full of fish, they take all the night soil, and drain the surface of the ground, which only stands a few inches above the level of the water in them as a rule. It is now proposed to place behind them a second parallel line of canals to meet the needs of the growing town towards the west both in respect to drainage and night soil disposal. Their construction, coupled with the filling in of the swamps, the ditches and depressed areas lying between them and the existing canals, would make a large difference to Belize, and add a valuable building area to the town.

METHOD OF RECLAMATION AND FILLING IN.¹

The Superintendent of Public Works has recommended the use of the sand pump on an extensive scale. The work which this machine has accomplished in the Southern States of America, where low swamp land is abundant, is well known. Galveston has been converted into a new city, raised high above sea-level. At New Orleans with the sand dredge I am informed that eight acres of land were filled in to an average depth of 12 feet, at a cost of \$100 a day, or a total of \$2,800. The length of pipe used to distribute the material was 300 to 500 feet. In Boston a considerable tract has in the same way been reclaimed. In my judgment the sand dredge will probably offer in all those towns like Belize, Bathurst, &c., which are in places below sea-level, one of the most successful and cheapest methods of dealing with swamps and the malaria problem. Given the sea, and a suitable bottom, the dredgings can be pumped to where they are required, the roads and lots properly levelled, and the pools and shallow drains filled in.

The more closely the conditions in low-lying swamp surrounding tropical towns are studied the more evident is it that the English methods of drainage are very frequently not applicable, and that considerable sums of money have often been spent upon them in the past, with very often the disadvantageous result of bringing about the formation of permanent pools and the diffusion of *Anopheles* throughout the town. In the case of the low-lying ground, the soil as previously mentioned, is but a thin crust upon a waterlogged or spongy loose substratum, and could deal with the heavy rainfalls without the necessity of side drains. Admittedly, immediately after heavy rain, there is no doubt that there would be some flooding of the roadway here and there, but it would be only for a very short time, as percolation is rapid. But even so, it is infinitely more important to the health of the community to get rid of *Anopheles*, and possibly *Stegomyia*, breeding pools, sources of the chief causes of sickness and death in the district.

The drainage problem of Belize is therefore not a question of cutting drains, but one of levelling up with porous dredged material, and of making uniform slopes between the sea shore and the canals, and in the back of the town, between the old canals and the proposed new canals; in other words, the construction of two parallel series of slightly elevated long turtle backs. Both roadways and plots would be uniformly graded, and except close to the canals and close to the shore, no open storm-water drains would be required.

SEWAGE AND NIGHT SOIL DISPOSAL.

Both these problems, unlike the case in the Southern States or in Central America, are comparatively simple. There are no sewers, and they are not needed; they would on the contrary be harmful in a town so flat and only standing at sea-level or a few inches above. The absorbent ground will

¹ By the Belize Improvement Ordinance, 1903, power is given to order the filling up of lots or low land to a prescribed level with dredgings to be purchased from the Board or otherwise. At the present time the cost stands in the way.

fortunately take a considerable amount of slop waste, and the sea and the canals deal with the more offensive portion.

The *latrines* are run out to sea or are placed over the canals. In the latter situation they do not cause the nuisance that might be expected from them, except when the water in the canals is very low. The reason being that Belize is exceedingly fortunate in possessing *cat-fish* which are very abundant along the sea shore, in the canals, and in some parts of the swamps; they greedily devour all decomposed animal garbage and effectively deal with all faecal matter, which should be thrown into the sea or canals between the hours of 8 p.m. and 6 a.m. The result of both the prompt removal and destruction of decomposable garbage and the absorbent nature of the soil, where not waterlogged, is absence of offensive odour, and of the abominable cess-pits found in other towns. None should be allowed under any circumstances. It is, in my opinion, unfortunate that Section 8 of Ordinance 19, 1897, implies that it is lawful to construct cess-pits under certain conditions.

The position of the *latrines* calls for attention, they should only be placed where there is a circulation of water, and therefore abundant *cat-fish*. In Fig. 12 will, however, be seen a *latrine* on the edge of the swamp.¹ In addition, there is a considerable amount of night soil dumping both into unsuitable swampy ground and ditches close by, this should be prevented, as it is steadily bringing about soil pollution. To remedy the defect and to encourage cleanliness the new canals should be proceeded with as soon as possible.

REFUSE DISPOSAL.

Compared with American tropical towns, the lots in Belize stand out favourably. But there is not the same neatness of the yards amongst the poorer classes as is seen, for example, in Conakry, in the French Guinea. This is no doubt in a great measure due to the submerged and waterlogged condition of the yards, and the persevering attempts of the owners and occupiers to raise the level of their compounds with mahogany chips, tin cans, bottles, conch shells, brushwood, and everything else that will not disintegrate immediately. There is a disadvantage in this as black ooze is formed. The occupiers of the houses should be instructed to bury the solid rubbish whenever possible, and to use the soil for levelling up purposes.

The District Board itself does not show the example it should do over this very simple matter, "The rubbish is thrown on to the dumping ground, which is largely composed of swamp land." Dry material, as leaf and paper, should be burnt at suitable places. A certain number of dustbins are provided at different parts of the town. The appearance of piles of scrap-iron and tins, old broken-down iron tanks, and other rubbish is offensive. It could be remedied at once.

Under Section 28 of the Public Health Ordinance, Belize, 1894, unsuitable

¹ By Section 34 of the Public Health Ordinance, 1894, Belize, it is unlawful to erect *latrines* over canals, river or sea shore, without approval of the Board; and by Section 35 it can be ordered to be removed.

material for filling in purposes is dealt with, and in the explanatory text accompanying the section the following sentence occurs, p. 17, "The employment of swamp lands in the vicinity of towns as 'dumping grounds' for refuse should be strenuously avoided. For already such lands, in addition to being saturated with moisture, contain an amount of decaying vegetable matter."

In Belize every scrap of solid material is wanted for filling in, but the filling in should be properly supervised by the Board.

CLEARING OF BUSH IN THE SWAMPS AND TOWN LOTS.

Belize had allowed itself up to this year to be overgrown by bush.¹ I readily assented to a plan of the Superintendent of Public Works, which had already received the approval of the Legislature, that the bush be cut back to the line indicated on Plans I.-III. The result of the clearance has been that the winds have for the first time been able to effectively penetrate to the back of the town, and houses which had been built into the mangrove swamp became visible. The residents living in the back of the town have welcomed the change. When the clearing work commenced in 1905, it was found that owners of property had been allowed to let the bush in their lots flourish, and very numerous notices to clear had to be suddenly sent out. A repetition of this is not desirable, for unless the money spent in the clearance is to be wasted, the cleared ground must be kept free from bush, and it should be the duty of the District Board to ensure that this is done.

The odour arising from the mangrove swamp is often complained of; apart from the unpleasantness, I am not aware of anything specific having been attributed to it that is based on scientific observation. THERE IS, HOWEVER, NO DOUBT THAT THE FILLING UP OF THE CLEARED GROUND WITH DREDGINGS, AND THE CANALISATION PREVIOUSLY DESCRIBED, WOULD MAKE A VAST IMPROVEMENT, RENDER THE YARDS OF HOUSES DRY, AND AFFORD BUILDING SITES OF VALUE.

BUILDING REGULATIONS.

When I first made my inspection in company with the Superintendent of Public Works of the town lots in the back of the town, a feature which stood out prominently was the absolutely unorganised arrangement of buildings. The official town plans which we had were to a large extent useless; what should have been open roadways had been blocked up by houses. Evidently there was no plan guiding the laying out of streets—houses were dumped down and unnumbered, the whole arrangement making it extremely difficult for proper sanitary supervision and inspection. Houses neglected and falling to pieces, with neglected *Stegomyia* breeding cisterns, side by side with those inhabited, produced the impression of very little systematic inspection, or of very little enforcing of the Public Health Act. The contrast in this respect to the older portion of Belize, or to what the Mexicans have done at Payo-Obispo, was very marked.

If I might venture to offer a small criticism, as the result of visiting tropical towns in our Possessions, it would be to draw attention to the fact

¹ By Ordinance 19 of 1897, powers are given to compel owners to clean their lots from bush. In 1905 the Board became very active in the matter.

that it is not uncommon to find that the English Public Health Act of 1875 is freely adopted, with a few modifications, to govern the health needs of a tropical town. In this way a detailed and useful Act applicable to large cities and comparatively thickly populated districts in England is used for the preservation of health in a tropical country, with native populations, and for diseases for which we have no provision in England, although they are the chief causes of disease in the tropical country. Thus, whilst no less than nineteen sections deal with cemeteries in the Public Health Ordinance, Belize, 1894, together with a whole page of explanatory text, I find no sanitary building bye-laws nor Ordinance to control the water supply. It is but just to state that an efficient measure to control the water was brought in, but it was repealed, and, as has been found, with disastrous results. In the same way urgently needed sanitary building bye-laws were introduced September 2nd, 1902, by Mr. Cork, the then chairman of the District Board of Belize. I reproduce them, together with the deletions as recommended by a special committee appointed to consider them.

No one will doubt to-day the wisdom of these measures as proposed by Mr. Cork; for some reason some of the most essential features were deleted by the Committee of the Board and the measure was not persevered in.

I recommend—having personally examined the insanitary state of nearly all the lots in the back of the town, where only extension can take place—that measures similar to those introduced by Mr. Cork in 1902 are most urgently needed for the sanitary control of the city.¹

THE PROPOSED BUILDING BYE-LAWS.

Sanitary Building Bye-laws drafted by the Chairman of the Belize District Board (Mr. Cork), and read at a meeting on the 2nd September, 1902.

1. No house, building, or other structure in the Town of Belize shall be erected, altered or extended without the previous consent in writing of the District Board.

2. Persons desirous of erecting new buildings or of altering or extending existing structures, should make application for the consent of the District Board.

3. All such applications must be accompanied by a plan giving the boundaries of the site on which it is proposed to build, with some indication of the character of surrounding properties.

4. The Board may require any or all of such applicants to produce also a plan or plans and sections of any such proposed new building, addition or alteration, which drawings must embody all the information required by the Board as to the sanitary and structural fitness of the building for the purposes proposed.

Report of Special Committee appointed to consider draft Sanitary Building Bye-laws, on 25th September, 1902, as per contra.

Amended to read:—No house used as a dwelling, for purpose of trade or assemblies of any kind, within the prescribed line of the town of Belize shall be erected without the previous consent in writing of the District Board.

No. 2 be deleted.

No. 3 be amended to read:—All applications for such consent must be accompanied by a plan giving the boundaries of the site on which it is proposed to build.

No. 4 amended to read:—The Board may require any or all of such applicants to furnish such information as the Board may deem necessary.

¹ Paragraph (g) of Section 17 of Ordinance 30 of 1894 specifically states that it should be the duty of the District Board "generally to perform all duties and functions, and to do such acts as may be necessary for the improvement, development, and conservancy of the district."

5. Before granting permission the Board will satisfy itself that the following requirements are met as far as possible.

(a) *Site and Air Space*.—The proposed site of the building and the yard must be filled up to the "prescribed level," as defined in chap. 114 of the C.L.

The building to be erected must not encroach on public streets beyond the general existing frontage of adjacent properties.

Piazzas or balconies must not overhang public streets.

An open space clear of all buildings should be left on each site of an area not less than the superficial area of inhabited rooms on the ground floor, exclusive of kitchens and out-buildings.

(b) *Ground Floor*.—No building shall be approved unless the ground floor is properly raised at least 18 inches above the level of the ground.

(c) *Chimneys, Fireplaces, &c.*—All smoke flues must be of incombustible materials, and proper fireplaces built for cooking or other purposes.

(d) *Water Supply*.—A vat or water tank to contain not less than gallons for every square foot of ground covered by each house must be provided for, with gutters to lead water from the roof. The openings of all such vats or water tanks must be protected by a covering of wire netting with a mesh small enough to prevent ingress by mosquitoes.

(e) *Wells*.—The sinking or maintenance of wells for any purpose whatever in the town of Belize will not be allowed without the special consent in writing of the Board.

Deleted.

Deleted.

Deleted.

Deleted.

Deleted.

That (b) be amended to read:—That the ground floor of houses on swampy lots be not less than 4 feet above such lots.

That (c) be deleted.

That (d) be amended:—Houses erected after the passing of these bye-laws shall be provided with means for storing not less than one and a half gallons of water for each square foot of inhabited floor space.

HEIGHT OF BUILDINGS ABOVE GROUND.

A glance at the photographs will show that a considerable number of the houses are raised on piles. This is necessary owing to the floods and to dwelling in the swamp. A large number of dwelling houses are raised only a few inches above ground, a space being left into which only vermin can crawl and dirt accumulate. This class of dwelling house should be prohibited as insanitary and likely to encourage rats, for the space beneath the house should be of sufficient height to allow of free inspection.

There is a penalty for building on ground filled up with offensive material, which I conclude must include swamp ground. See Section 4, Ordinance 19, 1897.

PROVISION FOR WASH-HOUSES.

No provision at present exists, the washing being done in the backyards. I would not lay stress upon this subject were it not for the fact that the washing at home leads to the accumulation of a great assortment of barrels and kerosene tins. (Figs. 1-2.) These all harbour mosquitoes, and when a Screening Ordinance is brought in there may be some objection from this cause. It might therefore, be deemed advisable to erect near the canal, shore

or river a trial wash-house, similar to those which have proved so successful at Conakry. It is only necessary that they should be of the simplest construction, and connected and supplied with water from a public vat close by.

SANITARY ADMINISTRATION OF BELIZE.

The Governor-in-Council constitutes the Central Board of Health (Section 3, Public Health Ordinance, 1894).

The *District Board*, with a medical officer or other health officer, may be appointed by the Governor-in-Council, the *Local Board of Health* (Section 12, Ordinance 30, 1894). The *District Surveyor*, appointed by the Governor, is the chief executive officer of the District Board, subject to the superior authority of the Chairman of the Board, who is, ex-officio, the Colonial Secretary. The Governor appoints health officers, inspectors of nuisances, and such other officers as may be necessary to carry out the provisions of the Health Ordinance, 1894, under the direction of the District Board. The Colonial Surgeon for the whole Colony and the Assistant Colonial Surgeons for their districts are health officers.

The powers of the Central Board of Health, that is, of the Governor-in-Council, are very great, and control the sanitation of the Colony. The District Board becomes the Board of Health, and is entrusted with the carrying out of the provisions of the Health Ordinance in its district, it is essentially a local body in Belize. The Central Board therefore controls both local or internal sanitation through its executive the Local Boards, and the external sanitary protective measures for the Colony, viz., quarantine, through the special Quarantine Board in Belize, or through Local Boards of Health in other districts when entrusted with quarantine powers.

Until this year the sanitary work has been almost wholly internal, and done through the Local Boards; this year the Central Board was active with quarantine.

The scope of the work under the District Board may be gauged by the fact that it has the following Committees :—Sanitary, Streets, Cemeteries, Markets and Slaughter-house, Fire, Cays, Scrutiny and Improvements. The machinery which it possesses to carry out its sanitary duties, and it must not be forgotten that the District Board is the Local Board of Health, are as follows :—

1. One Inspector of Nuisances, whose whole time is devoted to sanitary inspection, and who reports daily to the Colonial Surgeon.

2. Two other Inspectors, one of whom at least has also other duties to perform.

Thirteen scavengers.

Five carts.

For the purposes of sanitary inspection the town is divided into eight districts. Two inspectors are at work from Monday to Saturday. Each district takes three days. The eight districts are inspected in two weeks. The two inspectors work on opposite sides of the river. (According to statement furnished to Superintendent of Public Works, 1905.)

The Chief Inspector reports to the Colonial Surgeon, who reports to the Board, which then decides what action shall be taken. The notices for the abatement of nuisance are signed by the Chairman of the Board.

The Position of the Medical Officer.—According to Section 12 of Ordinance 30, 1904, before cited, the Governor-in-Council can appoint at any time "The District Board in any District, together with a Medical Officer or other Health Officer, to be the Local Board of Health within such district." From 1903 to 1905 the Assistant Colonial Surgeon in Belize was the Medical Officer of the Board, but his duties and position do not appear to have been clearly defined, he appears not to have been a member of the Board, nor were the recommendations and resolutions of the Health Board ever referred to him for guidance or otherwise. As an instance of the want of direct relationship, I find that on April 20th, 1904, that is one year before the outbreak of yellow fever, the then Medical Officer to the Board wrote pointing out that the sanitary inspection of the town was not carried out satisfactorily, the Inspector of Nuisances having too many duties to attend to. An Assistant Inspector was appointed, but he, too, owing to other duties, could not give his whole time. For a considerable time previous to the year 1903 there does not appear to have been a medical officer of the Colony on the Board, as it is stated that the Colonial Surgeon had resigned, and when in 1903 the Assistant Colonial Surgeon was appointed Medical Officer of Health he does not appear to have been nominated a member of the Board, nor to have been in very direct touch with the Board, as least so far as I can ascertain. The connection was certainly not such as exists between a Medical Officer of Health and a Board of Health in England. In 1905 the Senior Colonial Surgeon was made Health Officer for Belize, taking a seat on the Board, the Assistant Colonial Surgeon directing his whole attention to the quarantine. On June 1st, 1905, a memorandum was drawn up, with the approval of the Governor, as a guide for the "*Public Health duties of the Colonial Surgeon as Health Officer for the Colony and Health Officer for the Local Board of Health for the Belize District.*" But this memorandum is simply a recitation of the duties of a Medical Officer of Health, in the dual capacity of medical adviser to the Central Board of Health, and Health Officer to the Local Board.

As Health Officer to the Local Board, he is so only in an advisory capacity, he is not, as the District Surveyor, an executive officer of the Board. There is therefore no medical executive officer to the Board.

The experience of this year shows that sanitary control and inspection must be more vigilant and practical in the future than in the past, and more adapted to meet the conditions of tropical health conditions than at present. In the first place, dealing with the local sanitation of Belize, I am of opinion that it would be more advantageous and economical for the Local Board of Belize to have control of a responsible, well-trained and practical sanitary surveyor or engineer, well versed in modern sanitation as applied to the tropics, who should understand practically, and be made responsible for the execution of, the new measures of water screening, bush clearing, scavenging, drainage, fumigation, &c., especially directed to the prevention of yellow fever and malaria, as

well as for the execution of the other duties falling in the province of a Health Board. Such an official is wanted for the effective and sympathetic execution of those measures which science has proved to be most efficacious in dealing with tropical sanitation. An official out of touch with this form of sanitation, and who, from his past training, does not realise the significance of modern methods, is useless. I would recommend that this officer have the charge of Assistant Inspectors, scavengers, and the appliances necessary for carrying out the Health Ordinances, subject to the authority of the Board. He should be appointed by the Governor. I do not think that it would be necessary, if such an officer as mentioned above were appointed, that there should also be a Medical Officer of Health as a part of the executive machinery of the Local Board. The experience of the past shows that the failure to keep out yellow fever and to stamp out malaria is due to want of sufficient trained executive. If the principal medical officer of the Colony as well as one or more of the local medical men are on the Local Board they are sufficient to advise on the sanitary policy of the Board, without going to the expense of securing the services of another medical expert adviser directly under their control. The Local Board has in the past been the machinery through which the Central Board has operated, and as such it has gained considerable experience, and the lay members of the Board have been encouraged to take an active part in the administration of the city; if it is not strengthened then the sanitary execution must be taken over by the Central Board, who would appoint and direct their own officers.

A good sanitary engineer or surveyor, if left entirely to his work and not taken off by clerical duties, would get the maximum of work out of his workmen, and would thus save the Board. I am convinced that it is very false economy to oblige a practical outdoor sanitary engineer to do clerical work; it is exceedingly rare to find a man of this class gifted in both directions. The District Board possesses a clerical staff and good premises, this staff should do all the clerical work necessary.

Sanitation of the Colony.—This rests with the Central Board. Their duty is to obtain the maximum of efficiency from the various Health Boards throughout the Colony, and to guard the coast and frontiers from the invasion of disease. The executive officer for this supreme Board should be the principal medical officer.

Quarantine can with advantage be administered either by special quarantine boards appointed (see chapter on quarantine), or by the Local Boards of Health, in conjunction with the District Medical Officer, who would make the inspections and who would issue a certificate of Health before the Bill of Health was made out. The quarantine at Belize is under the direct charge of the Quarantine Board, its executive medical officer might be the principal medical officer.

With regard to the large local hospital, asylum and prison, and the medical work entailed by them, I am of opinion that the present very excellent hospital and asylum are essentially local institutions, that is, that they have no share in guarding the Colony from the entrance of disease or in preventing the spread of infectious diseases, all of which are of vital importance to the whole Colony. Apart from the salaries of the medical officers—viz., the Colonial Surgeon and Assistant Colonial Surgeon, they

require nearly \$19,000 per annum for maintenance. The revenue from fees is some \$1,700, the rest falls on the Colonial estimates.

I think that it is quite time that the inhabitants of the towns of the Colony took more direct interest in their local charities, and that all classes of citizens realised that it was their duty not to make this local charity a burden on the Colonial Finances but to relieve them of it, and permit the Colonial Government to advance the interests of the Colony in much needed directions. The present Assistant Medical Officer devotes a very considerable time to the care of the hospital; and the hospital is excellent, of very great interest, and affords a wide field for study. At the same time I venture to think that the clinical work on his shoulders might be very materially reduced if the local practitioners were allowed a share in the clinical administration of the wards.

CHAPTER VI.

THE PREVALENCE OF MALARIA IN BELIZE AND IN OTHER DISTRICTS OF BRITISH HONDURAS.

As Malaria is the other great mosquito-borne disease, it is of interest to examine its prevalence in British Honduras, and the measures which should be adopted to eradicate or reduce it.

An analysis of the returns of the Colonial Surgeon, and of the Assistant Colonial Surgeon, shows that malarial fevers are responsible for the largest number of deaths from disease in the Colony. From this we may safely infer that Malaria is also the cause of the greatest amount of sickness in British Honduras. In Belize this is borne out by the experience of the medical practitioners.

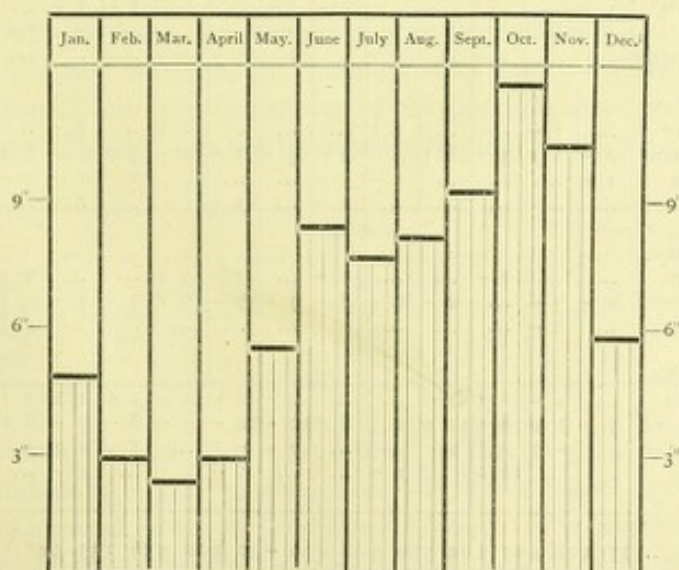
In the hospital at Belize the largest number of entries takes place under the heading of Malaria.

I insert three tables. Table I. shows the principal causes of death for 1904. It will be seen that malarial fever produces more deaths in Belize and in the Districts than any other disease. After malarial fever in importance comes intestinal affections, including Dysentery, due to sources of contaminated water supply.

Table II. is the monthly return of malarial cases treated in the Hospital in Belize during the last four years. It will be seen that cases occur throughout the year; they are most abundant, however, in the last quarter of the year, and are fewest in number in January, February, March and April. It will be observed from comparison with the rainfall table that this

CHART SHEWING AVERAGE MONTHLY RAINFALL IN INCHES.

(FROM RECORDS OF 1883-1904 INCLUSIVE. MEDICAL OFFICER'S REPORT, BELIZE.)



distribution corresponds approximately with the smaller rainfall in the first four months, and the much larger rainfall in summer and autumn. The total number of wet days is much less during the first four months than at any other period of the year, and the average temperature is less. On the other hand, as seen in Table III., the number of cases treated by the local medical men appears greater in the first quarter of the year.

TABLE I.

MORTALITY PER 1,000 FROM SOME OF THE PRINCIPAL CAUSES OF DEATH FOR 1904.
(*Medical Officer's Report taken from Report of Registrar General, Belize, 1905.*)

Principal Causes of Death.	Belize District.	Corosol District.	Orange Walk District.	Stann Creek District.	Toledo District.	Cayo District.	The Colony.
Malarial Fevers ...	3'341	12'771	11'842	5'280	12'150	10'605	8'117
Dysentery ...	0'477	1'146	1'532	0'960	0'639	2'052	0'957
Phthisis Pulmon. ...	1'841	0'982	0'835	1'680	0'213	1'026	1'260
Nervous Diseases ...	2'932	2'619	2'507	0'720	1'065	0'342	2'167
Circulatory „ ...	0'954	0'163	0'189	...	0'852	0'684	0'554
Respiratory „ ...	1'968	1'309	0'835	1'680	2'344	0'684	1'436
Intestinal „ ...	2'591	2'456	0'835	1'680	2'984	1'710	2'142
Death Rate ...	24'482	28'981	23'684	20'643	27'497	23'268	24'931

TABLE II.
BELIZE HOSPITAL.
MONTHLY RETURN OF CASES GROUPED UNDER MALARIA FOR YEARS 1901, 1902, 1903, 1904.
(Assistant Colonial Surgeon's Report.)
C = Cases. D = Deaths.

Months.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly.	Total.
Diseases.	C. D.	C. D.	C. D.	C. D.	C. D.	C. D.	C. D.	C. D.	C. D.	C. D.	C. D.	C. D.	C. D.	C. D.
MALARIAL FEVER.														
1901 (a) Intermittent	4 1	4 -	...	2 -	3 -	3 -	5 -	5 -	11 -	10 1	9 -	9 1	65 3	80
(b) Remittent	1 1	...	...	...	...	3 -	1 -	...	...	1 -	1 -	...	7 1	
(c) Malarial cachexia	...	...	2 -	...	2 1	...	2 -	1 -	1 -	...	...	...	8 1	
MALARIAL FEVER.														
1902 (a) Remittent	...	1 -	...	...	1 1	...	...	...	1 1	...	2 -	...	5 2	59
(b) Intermittent	2 -	1 1	3 -	6 1	3 -	3 -	1 -	5 -	9 1	2 -	8 1	...	46 4	
(c) Febricula	1 -	...	...	...	1 -	1 -	...	...	...	1 -	1 -	1 -	6 -	
(d) Cachexia	...	...	...	...	...	1 -	...	1 -	...	...	...	...	2 -	
MALARIAL FEVER.														
1903 (a) Remittent	...	...	1 -	...	...	1 -	...	1 -	3 1	...	...	2 2	8 3	79
(b) Intermittent	2 -	3 -	...	2 -	6 -	8 -	7 -	7 -	9 1	7 -	7 -	9 1	67 2	
(c) Cachexia	...	1 -	...	...	...	...	...	...	...	...	...	3 1	4 1	
MALARIAL FEVER.														
1904 (a) Remittent	...	2 -	- 1	2 -	...	...	...	1 -	2 -	1 1	1 1	1 1	10 4	128
(b) Intermittent	7 -	6 2	8 -	11 2	12 1	8 -	10 -	14 -	9 -	6 -	7 -	8 1	106 6	
(c) Cachexia	...	- 1	...	1 -	...	...	2 -	- 1	...	1 -	2 2	1 -	7 4	
(d) Febricula	...	...	1 -	...	1 -	...	...	1 -	1 -	...	1 -	...	5 -	
TOTAL ...	17 2	18 4	15 1	24 3	29 3	28 -	30 -	32 1	42 3	36 3	33 3	42 8		

From this table it appears that the total number of cases of Malaria in 1904 were far greater than in the preceding three years, although the total number of cases treated in the wards (approximately 500) had not increased. With regard to the classification of the cases of Malaria adopted here, it would be far better to replace it as soon as possible by the following :—
“ Simple tertian,” “ Malignant tertian,” “ Quartan ” (microscopically confirmed).

In this table (III.) I give the number of cases of Malaria which have occurred in the practice of four physicians in Belize from January to October 1st, 1905.

TABLE III.

January	...	...	...	...	...	...	106
February	...	...	...	...	...	...	66
March	...	...	...	...	...	...	65
April	...	...	...	...	...	...	104
May	...	...	...	...	...	...	82
June	...	...	...	...	...	...	43
July	...	...	...	...	...	...	49
August	...	...	...	...	...	...	41
September	...	...	...	...	...	...	58
TOTAL							<u>614</u>

The number so far this year, 1905, is not regarded as abnormal. The figures for the various months do not tally with the hospital returns, which show a larger proportion towards the end of the year. In January there was a considerable number, and also in April and May, just before the Yellow fever outbreak. The return of the mahogany cutters and their families from the interior to Belize towards the end of the year brings into the town a considerable number of cases, and allowance has to be made for these imported cases; but, nevertheless, an analysis of the individual cases shows that the primary cases of infection in Belize itself are very great, and whole families may get the “Fever.” Cases of Malaria are found scattered throughout the town, many occur in the “Over Pond,” Yarbrough, Free-town, the North portion of the Town in the neighbourhood of Gabourel Lane, Barrack Road, Pigstock Street and Victoria Street.

In his comment upon the number of deaths registered in 1904 in Corosal, the Assistant Colonial Surgeon, Dr. Gann, remarks that whilst the total death rate of Corosal District was less than in any of the previous three years, the number of deaths from “Fever” was the highest for the four years, viz. :—

Year.	Total Deaths.	“Fever.”
1901	223	73
1902	201	87
1903	190	70
1904	177	92

This increase in Malaria he attributed to the extraordinary presence of fever of a remittent type, and partly also to the introduction into the town of a *particularly malignant form of remittent Malaria by a number of deserters from the Mexican troops stationed at Payo-Obispo and Bacalar*, at both of which

places similar forms of fever were very prevalent. In 1903 the Medical Officer also referred to the introduction of a highly malignant remittent fever brought from Corosal and places on the Mexican side of the Rio Hondo.

In 1905 the Medical Officer for the Orange Walk District in the north of the Colony, states in his Report for 1904, that Malaria was unusually prevalent, being "quite epidemic in July and August." The type was mild, but there was one fatal case of Black water. The number of deaths registered was 88, of a total of 170; there were also 17 deaths ascribed to convulsions, some of which were, the Medical Officer thinks, due to Malaria. In both Corosal and Orange Walk the rainfall was excessive in 1904.

The increase in the severity of Malaria in British Honduras and (apparently from report) in surrounding Republics in 1904, may point to the presence of general conditions favourable to malarial propagation, namely, railway and other works necessitating the transference and congregation of large bodies of workmen and meteorological conditions favourable to the development of the *Anopheles*. In the adjoining portions of the Republic of Mexico and Guatemala large bodies of men have been massed and moved for various industrial enterprises in 1904, and many of the labourers came from Belize and Districts; but it would be difficult to say whether in 1904 meteorological conditions were more suitable than in other years or not. It is known that in some districts the rainfall was very high, in others it appeared normal, and there are no reports from many districts. In countries liable to Yellow fever a sharp look-out should be kept for any increase in number and severity of Malaria cases, especially where railway or other great industrial works are in progress, for it is quite possible that cases of Yellow fever may be mistaken for pernicious forms of Malaria. In this connection it is of interest to observe that the series of epidemics of Yellow fever in Belize, which commenced in 1886, were preceded by a very large increase of malarial cases, as shown by the Hospital return of 1885, and I further note that the Medical Officer in his report of the 1890 epidemic states, that "at the end of 1889 exceptional floods were followed by an unusually severe outbreak of malarial fevers." We have now evidence which shows that some of them might have been cases of Yellow fever.

Conditions which favour the development of Anopheles in Belize and other towns in British Honduras.—In Belize and Corosal the houses are surrounded by swamp on the land side, and the ground is only a few inches above sea level in many places. Water finds its way slowly from the swamps or higher land at the back by means of the grass grown gutters along the streets, or rain water collects in the shallow pools and drains in compounds and roadways; in either case the *Anopheles* is given favourable opportunities of breeding. In Plan III. of the *Anopheles* breeding places in Belize it will be seen that the distribution is very wide spread. The larvæ are most abundant in the grass plots at the north and south ends of the town, namely, at the Barracks, Freetown and Yarborough. In these places there are numerous shallow weed-grown ponds and ditches containing clear water, and to a certain extent free from the innumerable fish present in the swamp. Along many of the streets there are shallow weed-grown drains, which it is true are often flushed by the heavy rains and the inundations from high tides, but the weeds no doubt act as

screens or sponges, and *Anopheles* larvæ can usually be discovered. I have found them in the following streets, Wilson, Castle, Kelly, Pickstock, Victoria, Freetown Road, West, Dean, Plues, &c.

From the proximity of the swamps and marshes it is safe to infer that *Anopheles* are present throughout the year, but they are most abundant when the pools and drains in the road in the rainy months become suitable breeding places.

In Corosal, Punta Gorda and Stann Creek I also found *Anopheles* larvæ in ditches and pools, and there can be no doubt that they are abundant and that the thatched cottages of the poor in the low lying and marshy parts of the towns are much frequented by the adult mosquitoes.

The houses placed on the sea front both at Belize and at the other coast towns are much more favourably situated than those in the marshes and swamp land, but in Belize in spite of this fact, the private houses at the Barracks and at Yarborough become *Anopheles* infected because on the land side they are surrounded by *Anopheles* bearing marsh land.

PROPHYLAXIS AND SEGREGATION.

There is abundant evidence of the presence of *Anopheles* (species not precisely determined) and of the sickness and deaths caused by Malaria, at the same time it is unfortunate that a more systematic examination of the blood has not been undertaken. Information is required to tell us the percentage of children and young adults harbouring malarial parasites. A systematic analysis of this kind is as important as ascertaining the breeding places of the mosquito, for without malarial parasites in the blood mosquitoes could not become infected. At the present moment we have not this necessary information, but from clinical evidence there is, however, abundant proof that "Fever" is common in the town.

The Europeans live for the most part on the sea front, away from the poorer districts, and there is thus some degree of segregation. There is also a good row of isolated residences on the Barrack grounds, but, as previously mentioned, they are surrounded on the swamp side by *Anopheles* pools, and as many of the houses have become infected with Malaria, they are not safe for new comers at the present.

Suggested Improvements.—Instead of contemplating further immediate segregation, I strongly urge the beneficial effects which would accrue to all classes of the community if the smaller drains, pools and marshy patches were filled in, and the waterlogged lots in the back of the town filled up from the sandy material in the harbour. Without seeing Belize it is impossible to realise the disadvantage of inundation and water-logging from which the town now suffers, or to appreciate what a few inches of dredged sand or mud spread over the lots would do for the comfort and health of the community. A very few inches of sand would prevent the formation of puddles, as the rain readily soaks through.

In addition to raising the level of the ground, the canals require improvement and extension. It is of the greatest importance to get as much salt water as possible to circulate in the lagoons, blind canals, and the large stagnant pools; this can be done by cutting the canals through to the sea in a few places. The rise and fall of the tidal water, increased brackishness, and above all the numerous fishes which are favoured, tend to prevent the development of *Anopheles*.

CHAPTER VII.

REPORT UPON THE THREE PRINCIPAL COAST TOWNS
OF BRITISH HONDURAS OTHER THAN BELIZE.

COROSAL.

A SMALL coast town at the extreme north of the Colony. It is situated at the mouth of the New River, and is about eleven miles distance from the rival Mexican town of Payo-Obispo at the mouth of the Rio Hondo. (See map of the Colony.)

For the purpose of this Report, Corosal is of interest on account of its close proximity to and its intercourse with the Mexican side, and for the circumstance that a case of supposed Yellow fever was reported there by the Medical Officer in 1900.

The number of inhabitants is given as 1,644, consisting of Spaniards, Creoles, Indians, Negroes, Coolies, Chinese, and a few Europeans.

The trade consists of logwood and mahogany wood cutting, and river and coast traffic. The latter is kept up by means of small sailing craft and canoes with stations on the New River, such as Orange Walk, and with settlements on both the English and Mexican banks of the Rio Hondo, Belize, Payo-Obispo and Xcalak. (See Map.)

Not only is there a constant direct and indirect intercourse between the Mexican and English sides by way of small boats, but workmen constantly cross over the Rio Hondo from Yucatan into British territory.

On the Mexican side, Yellow fever has been notified at various times during 1904-1905 at the towns of Vera Cruz, Merida, Progreso and Santa Cruz, whilst much disease described as malarial fever of a very severe type has been reported from Bacalar, where considerable numbers of workmen and troops have been stationed. There exists, therefore, risk of infection to the Colony via Corosal. We know that severe, undetermined types of malarial fever are introduced from the Mexican side by workmen from time to time, and if these cases can be introduced, so may Yellow fever. In February, 1900, Dr. Gann, the Assistant Colonial Surgeon stationed at Corosal, reported a case of what he considered to be Yellow fever. The disease occurred in an Indian at Xi-Be, a village near Corosal. The symptoms were high temperature rising to 106°. Intense pain in head and back. Conjunctivæ faintly jaundiced. Liver slightly enlarged. Spleen considerably enlarged. Urine scanty with albumen. Finally vomiting of "bright blood," and well marked jaundice before death. The pulse is not given, nor was a postmortem made. The Senior Colonial Surgeon did not accept the diagnosis, but he was under the disadvantage that he did not see the patient. The case was undoubtedly suspicious. Dr. Gann was of

opinion that the infection was brought into Xi-Be by some strange Indian who had crossed the Rio Hondo from the Yucatan side.

Corosal is surrounded by swamp, and there are numerous pools and street drains overgrown with weeds which afford a very favourable ground for the breeding of the Anopheles. I found Anopheles larvæ, the species of which I was unable to determine, in the street puddles, and Malaria is the prevalent disease. (See Medical Reports of Corosal, Chapter VI.)

The water supply of the town consists of some large water vats, and numerous odd receptacles and wells. I found larvæ abundant in all of those which I examined, and I was able to identify the *Stegomyia fasciata* in several yards. With the exception of the houses placed immediately on the sea front, and which have the advantage of a very refreshing breeze, the lots like those at Belize harbour the *Stegomyia* in large numbers, and if therefore a case of Yellow fever were introduced, the suitable mosquitoes are at hand to propagate the disease.

There has been no attempt at screening the cisterns, and there appeared to me to be many more barrels in proportion to regular cisterns than at Belize. In view of the fact that the inhabitants who for the most part are annual tenants have little interest in erecting suitable water reservoirs, the remedy of providing a properly screened water supply rests with the property owners of Corosal. A properly protected water supply system is undoubtedly needed, for in its present state Corosal is a very vulnerable spot in the Colony.

It is considered that it would be an easy matter to patrol the front of Corosal, and so prevent the introduction without quarantine of persons coming from infected districts, and it is also stated that the three "roads" which enter from the back of the town could be guarded in times of danger. I am of opinion, however, that if Yellow fever should break out on the Mexican side close to the British frontier the greatest difficulty would be encountered in preventing its introduction.

Not only should the water supply be remedied, but as Corosal is a port of entry into the Colony for shipping, liable to come from infected parts, there should be in addition a properly screened quarantine station. There is, it is true, a small general hospital, but it is of even greater importance to the prosperity of the Colony that there should be a small properly screened infectious diseases isolation hospital for the reception of real or suspicious cases. The Medical Officer in charge of Corosal ought to be furnished weekly with the health returns of other parts of the Colony, of Mexico and of adjacent Republics. In return the Medical Officer should furnish the Senior Colonial Surgeon at Belize with a weekly report of the health of the district. *There should be far more communication between the medical head of the Colony at Belize and the Medical Officers at the extreme ports of the Colony, Corosal and Punta Gorda than exists at present.*

CONSEJO AND PAYO-OBISPO.

Consejo is a very small village, some nine miles by sea to the north of Corosal on British territory, at the mouth of the Rio Hondo. It is thought

that, if a channel were dredged through the bar at the mouth of the Hondo and in British waters, the village might develop and flourish. If this dredging is carried out and Consejo is put in a position to develop, it is very essential that the town should be properly laid out and planned, and that the water should be strictly controlled by a proper screening ordinance at the outset.

PUNTA GORDA.

Punta Gorda is the port of entry to British territory at the extreme south of the Colony, and is some seventeen miles distant from the Port of Livingstone in Guatemala. It contains between 600 and 700 inhabitants, and the trade is chiefly a coasting one with other ports in British Honduras and with Spanish Honduras and Guatemala. There is some mahogany cutting, and there is a small settlement seven miles distant, of Americans, engaged in sugar planting.

As at Corosal the medical officer in charge acts as District Commissioner. The town is straggling and very much weed-grown. There are numerous pools and small courses, and the drinking water chiefly consists of rain water collected in vats and barrels. Some spring water is, however, used, and there are also wells, but the latter are not used for drinking purposes.

The various water storage receptacles are, as at Corosal, totally unprotected, and I found both the larvæ of *Stegomyia* and a few adult *Stegomyia fasciata* sheltering in the barrels. The *Stegomyia* is, as in other towns in the Colony, the common cistern mosquito. I found *Anopheles* larvæ, species undetermined, in one small stream.

There is no hospital at Punta Gorda; at one time there was, but the building intended for it has been rented out for other purposes. There is no infectious diseases isolation hospital. There is a shed at one end of the town used for quarantine purposes, but it is not screened. The following example demonstrates the want of suitable quarantine accommodation in Punta Gorda. Very recently a sloop arrived from Livingstone in Guatemala, an infected port, with 25 souls on board, chiefly Jamaican labourers. They could not be brought on shore for want of suitable accommodation, and the boat was placed in quarantine. During the night the craft was struck by lightning and sunk, one man was drowned, the others were rescued and taken to a hut in the village.

As Punta Gorda is the first port of entry into this Colony from ports in Guatemala and Honduras, it is necessary that it should be properly guarded. It is essential that there should always be a medical man stationed there, yet for some years it was left unprotected, the nearest medical officer being at Belize, 90 miles distant.

The water receptacles should be screened; a simple properly screened quarantine shed should also be provided as well as a small properly screened isolation hospital. As I recommended in the case of Corosal, so in Punta Gorda, the Medical Officer should be regularly furnished with the health reports of the surrounding Republics, and he in return should furnish weekly health returns to Belize. The quarantine inspection should be more systematic, and the clinical thermometer should be used as a matter of routine.

Although there is telephonic and telegraphic communication between Corosal on the one side and Punta Gorda on the other with the centre at Belize, nevertheless *I have been struck with what appears to me to be the medical isolation of these two places. These frontier posts for the preservation of the health of the Colony, and therefore of its commercial prosperity, are not in sufficient touch with what is going on in other places, there is not sufficient central inspection, and therefore correlation of the medical resources of the Colony. The result is the disheartening of the young medical officer, and as a consequence the tendency to relax the vigilance and interest necessary to safeguard the interests of the Colony.*

STANN CREEK.

This town is the second largest in the Colony. It lies between Punta Gorda and Belize, and is some 30 miles from the latter town. It contains about 2,800 inhabitants, 90 per cent. of whom are Caribs. It is the centre of the fruit industry. Although the second largest town in the Colony and a centre of trade for Carib settlements in the neighbouring Republics, it has no medical man and no quarantine arrangements. During the present infected condition of neighbouring states, it is true that boats are not allowed to disembark their passengers or crews, but as very many of these are small boats they can effect an entry at other places on the sea front, in the vicinity for example. It would certainly be to the interest of the preservation of the health of the Colony, and to the promotion of trade if proper quarantine arrangements were carried out, and a medical man appointed, and boats encouraged to enter the regular ports.

The place is at present medically unprotected and most vulnerable, and severe cases of injury have to be transported by boat 30 miles to the hospital at Belize.

As in the other towns of the Colony which I have visited the *Stegomyia fasciata* is readily found in the water barrels. I examined with Dr. Harrison a large number of the compounds and found larvæ present in almost all instances. There is no attempt at screening. The total number of vats and barrels is not, however, by any means as great in proportion as at Belize. The inhabitants do a very great deal of their washing on the sea front or in the river, thus using far less water. A very large proportion of the houses are roughly thatched and unsuitable for receptacles, and the women prefer to go to the river with their pitchers to draw the day's supply of drinking water. It would be quite feasible to provide well screened public tanks, and screen the few large vats at present existing, and to do away with the barrels and odd receptacles.

The Carib population is very cleanly and it takes care of its water—public tanks would be sufficient for their wants.

Although there are numerous marshy places I was unable to find *Anopheles* larvæ, they are no doubt abundant as malarial fevers are common in young subjects.

CHAPTER VIII.

YELLOW FEVER IN MEXICO AND IN THE CENTRAL
AMERICAN REPUBLICS WITH SPECIAL REFERENCE TO
THE FRUIT PORTS.

As the prosperity of British Honduras is very closely associated with that of the Republics which surround her, and as the recurrence of Yellow fever or plague in them seriously affects the British Colony, I have briefly reviewed in the following pages the position of Yellow fever in Mexico, and the Central American Republics, dwelling especially upon the outbreak of the present year, with the two-fold object of throwing light upon the recent epidemic in Belize, and of furnishing data for guidance in preventing recurrences in future.

With the object of obtaining first hand information and of observing the distribution of the *Stegomyia fasciata*, I visited not only Corosal, Stann Creek and Punta Gorda along the coast of British Honduras, but also Payo-Obispo in Yucatan, Livingston and Puerto Barrios in Guatemala, and Puerto Cortes in Spanish Honduras.

Under President Dias there has been a great development of trade in Mexico, especially in Yucatan, the nearest maritime province of Mexico to Cuba, and on our northern frontier. Still more recently the Mexican Government has assumed control of Chetumal Bay, has tried to revive the old town of Bacalar (see Map I.) and has brought into existence in three years the town of Payo-Obispo, and in every way is encouraging trade on the Mexican side of the Rio Hondo, our northern boundary. The Tehuantepec Inter-oceanic Railway across the Isthmus of Mexico has largely increased Mexican trade. With the increase of trade communication, has followed both the dissemination of Yellow fever to places before free, and an outbreak of plague; in addition at Bacalar near the British frontier, there has been reported very severe Malaria amongst the soldiers and labourers.

To the south of Belize the most remarkable development in the Central American Republics has been the Banana industry. Owing to this extensive and lucrative trade with the United States, many of the older coast towns have become important fruit ports, whilst new ports have sprung up and extensive tracts in the various Republics are now being actively reclaimed and put under fruit cultivation. A glance at Map II. will show the very large extent of coast line reaching from Belize to Bocas del Toro, in Panama, now engaged in the fruit traffic. Still more recently extensive tracts of country have been brought under rubber cultivation. There is a continuous stream of steamers passing between the fruit ports and ports in the United States. The development of the fruit trade has stimulated railway construction, so that the banana of the more fertile districts in

the interior may be rapidly transported to the coast. To the increased development of trade is probably due the outbreaks of fever at certain of the fruit ports, and its extension into the interior of Guatemala and Spanish Honduras, in the present year.

The fruit ports of Nicaragua and Costa Rica remained free this summer, but Yellow fever was present in the interior of Nicaragua and at Bocas del Toro.

Finally in Panama, like in Mexico, Yellow fever is endemic. Here there is an immense engineering enterprise under way, and already the United States Panama Canal Commission has over 9,000 employes on the Isthmus. The world is looking on with confidence to the United States Isthmus Commission being able to control and prevent the spread of Yellow fever in the canal zone. At present, however, there are cases of Yellow fever, and more recently plague has been announced. Thus on the northern and southern extremities of Central America, in the Republics in which most works of construction are being undertaken, Yellow fever is present and plague has occurred.

British Honduras differs from the surrounding Republics; it is as yet undeveloped, its only means of communication in the interior are the natural waterways; there are no roads and no railroads. Its commerce is concentrated on the coast at the mouths of the rivers. Its liability to infection is not from its land side, but comes through its coast towns with which, and the adjacent Republics, there is considerable trade in English goods; Belize being the centre for the distribution of English goods in Central America.

MEXICO.

Commercial expansion in Mexico has been greatly hindered by the presence of Yellow fever and the dread of epidemics. From 1878 to 1898 Tampico was free and its progress was correspondingly rapid; a set back occurred in 1898, and again in May of 1903, when a large number of people migrated and labour became exceedingly scarce.

In the same way Progreso, in Yucatan, nearer the British territory, which on account of its proximity to Cuba was expected to have a large trade with that Island and indirectly with the United States, was likewise thrown back through the fear of an epidemic. At Vera Cruz, with a population of 38,000, records from 1866 show that there has been an almost unbroken annual death rate from Yellow fever, as the following table shows:—

FROM THE YELLOW FEVER REPORT, 1903, OF THE UNITED STATES MARINE HOSPITAL SERVICE.

Year.	Deaths.	Year.	Deaths.	Year.	Deaths.	Year.	Deaths.
1866	264	1876	34	1886	208	1896	0
1867	332	1877	528	1887	4	1897	2
1868	187	1878	448	1888	3	1898	127
1869	10	1879	21	1889	2	1899	670
1870	11	1880	254	1890	40	1900	259
1871	271	1881	723	1891	180	1901	102
1872	215	1882	72	1892	259	1902	*
1873	322	1883	747	1893	131	1903	...
1874	79	1884	136	1894	209	1904	...
1875	425	1885	328	1895	143	1905	...

* I find it very difficult to obtain precise figures for these dates in 1903, the total number of cases appears very high, *i.e.*, over 1,000; with the advent of sound prophylactic measures the number of cases drop, and in 1904 some 76 cases are recorded, and 17 (?) in 1905.

Not much can be learnt by comparing these figures with the outbreaks at Belize, there does not appear to be any relationship; thus, whilst Belize was free since the epidemic of 1891 until the outbreak of this year, the Yellow fever persisted in Vera Cruz.

Thanks to the application of scientific methods since 1902, the number of cases at Vera Cruz are beginning to show a decline. At great cost, wharves were constructed at Vera Cruz, so that vessels might come alongside and discharge, but Cuba and the United States declared "infected" the vessels which went alongside, so that the money is to a considerable extent wasted, so long as Yellow fever persists. Since 1903, Belize has not had much direct communication with this port, owing to quarantine, but, as will be seen directly, there is much indirect intercourse.

The following figures prepared from data furnished by the weekly health returns of the Public Health and Marine Hospital Service show approximately the number of cases of Yellow fever in Mexico from January to December, 1905.

					Cases.	Deaths.
CITY OF MEXICO	...	...	...	...	1	1
OAXACA:—						
Tehuantepec	}	...	...	...	44	23
Tuxtepec						
Juchitan						
VERA CRUZ:—						
Coatzacoalcos	}	...	...	...	158	91
Texistepec						
Tierra Blanca						
Vera Cruz						
Soconusco						
Tezonapa						
Cordoba						
Omealca						
YUCATAN:—						
Merida	...	...	...	...	6	2

It is a great satisfaction to know that under the guidance of Dr. Liceaga, President of the Supreme Board of Health, Mexico is making a determined effort to rid the country of Yellow fever. Vera Cruz started the campaign; the State of Tamaulipas followed. Yucatan, on our frontier, has also undertaken a vigorous attack against the disease, appreciating the advantage to be gained both for its internal and foreign trade, by freeing itself from Yellow fever. It is believed that the States of Campeche, Tabasco, Chiapas, Oaxaca, Nuevo Leon and San Luis Potosi, in which although fever is not endemic, yet nevertheless spreads whenever it takes an epidemic form, will join in the campaign.

Of great importance to the future security of Central America is the fact that the severe epidemic of plague which broke out at Mazatlan was stopped in six months owing to vigorous application by the Board of the most recent methods of prevention in this disease.

In the campaign the authorities and citizens loyally combined under the direction of the medical officers.

THE PORTS OF PROGRESO (FOR MERIDA), ASCENSION BAY (FOR CHANSANTA-CRUZ, &c.), XCALAK, AGUADA AND PAYO-OBISPO (FOR BACALAR AND RIO HONDO TRADE ON THE BRITISH FRONTIER).

Progreso is the port of Merida, a city of considerable size in Yucatan. From a British Consular report I learn that the last case of Yellow fever in Progreso was on February 16th, 1905. From the same source a case of Yellow fever was reported in Merida, March 18th, 1905, and in the second week in September a case is announced at Merida in the official Mexican health report. These statements show that Yellow fever has existed in the Yucatan province of Mexico, that province which is adjacent to British Honduras and with which there is considerable trade. As in the case of Vera Cruz, there has not been much direct trade between Progreso and Belize since 1903, when quarantine was established, but there is indirect intercourse.

Payo-Obispo, on the north side of the mouth of the Hondo, is in Mexican territory, and although only three years old it appears to me to show signs of considerable vigour. It is the Mexican centre for developing the trade of the Hondo. There are some 300 inhabitants, a post and telegraph office and good workshop for repairing the stern wheelers used on the river. The houses are good, and wooden vats and barrels are used; there is no screening. Through Payo-Obispo pass the workmen on the way to Bacalar and settlements on the Hondo from Ascension Bay and other places in Mexico. They disembark on the Yucatan Coast at Xcalak, cross a small neck of land to a place called Aguada (in the Bay of Chetumal), and from thence across to Payo-Obispo. Payo-Obispo is thus in constant touch with other Mexican ports, and with ports, moreover, which have been severely visited by Yellow fever. Travellers from Progreso or from other ports in Mexico with foul bills of health can sail to Payo-Obispo either directly through the Cays and British waters, or may disembark at Xcalak and re-embark at Aguada and sail across to Payo-Obispo. From Payo-Obispo they can cross over to Corosal and from thence sail or steam to Belize. The indirect method of entering British territory emphasises the urgent necessity of most careful medical examination of all travellers entering Corosal or Payo-Obispo.

GUATEMALA.

THE PORTS OF LIVINGSTON, PUERTO BARRIOS, SANTA THOMAS, AND
INTERIOR TOWNS OF ZACAPA AND GUALAN.

Livingston in Guatemala is the first port after leaving British Honduras, and is about 17 miles from Punta Gorda. It is the chief town on the East Coast of Guatemala, and is a large fruit port, the principal fruit, bananas, being brought down by river for shipment by the fruit steamers

which call regularly. The population is estimated at 3,500, of which one-third are Spanish, and the remainder Carib. There are some thirty Europeans and Americans. There is an English and an American Consul. There is no government medical officer nor local medical practitioner. Dr. Peters, the representative of the United States Public Health and Marine Hospital Service, is, however, recognised as a medical adviser by the Guatemalans, and his directions are to a certain extent followed. The town appears to be well placed on the slope of a hill. The water supply is derived from cisterns and springs. I examined a considerable number of the lots, and found that in addition to the large wooden vats attached to the larger houses, barrels were everywhere present as in other coast towns. From my examination of the larvæ and mosquitoes, which I found, I am of opinion that the *Stegomyia fasciata* is here, as elsewhere, the common water receptacle mosquito. The larvæ were present in large numbers. During and since the recent epidemic, some oiling has been done, but, owing to the frequent rains, this is not effective, and the better remedy of screening has not been attempted so far. There appears to be little attempt at sanitary supervision, and the town is not equal in this respect to the coast towns in British Honduras.

THE RECENT YELLOW FEVER EPIDEMIC.

The last epidemic in Livingston, as in Belize, was in 1891, some cases are stated, however, to have occurred in 1892.

The first case in the recent epidemic occurred on 4th June and died on the 9th, and altogether there appears to have been some 45 cases and 18 deaths. The death rate amongst new residents was very high and largely confined to them. Dr. Peters reports a case on the 9th October, that is, 70 days after the last case.

The outbreak in Livingston is locally traced to Belize, the infection, either in the person of an infected native from Belize, or as infected *Stegomyias*, starting, it is supposed, in or near the wharf. It appears, however, to me, that it must of necessity be very difficult to attribute the outbreak to Belize in the north in preference to Puerto Cortes or Colon in the south. Fever was declared at Puerto Cortes at about the same time as at Belize, but the epidemic has been much more severe in Puerto Cortes, therefore the volume of infection in all probability at the time of declaring the outbreaks in both places would have been much greater in Cortes than in Belize. In addition, Puerto Cortes is about 56 miles from Livingston, Belize being 108 miles, but there is more traffic between Livingston and Belize. We also know that from Puerto Cortes a passenger, the Rev. Mr. Harvey, who was placed in quarantine on arrival in Belize, developed Yellow fever very shortly after arrival, and he must have been clearly infected in Puerto Cortes. If the infection in Livingston was due to Belize, the infection must have been carried there by a sick native or by *Stegomyias*, and we know that the latter method of conveyance by small open boats is difficult, although not impossible. It is, however, remarkable that the outbreak in Livingston followed at an interval of some 12 days, the outbreaks (as officially notified)

at Puerto Cortes and Belize. There is little doubt that the infection was imported, whether from the interior or from without, and soon made itself felt on the non-immune white population, but to what extent, and in what severity, and at what date it may have been present among the native Spanish and Carib non-immunes, it appears to me to be very difficult to say, as the natives are not communicative, and have been in the habit of doing without medical advice.

If Livingston is regarded as the primary focus, the fever appears to have spread from it into the interior of Guatemala following the railway line, which runs from Barrios to the interior. At Zacapa more especially, 103 miles from Puerto Barrios, the fever broke out on June 24th or 25th and was particularly virulent; 700 cases of fever are said to have occurred in a population of 6,000 inhabitants, and the mortality amongst the infected is given as 40%. The inhabitants are mostly Indian-Spanish, and it is evident that they must have been largely composed of non-immunes, and therefore the probability is that the town had not been visited by previous outbreaks as in the case of the coast towns, but that the *Stegomyia fasciata* was breeding there and was ready to receive infection once introduced. It is believed, locally, that the infection probably came from Livingston, as there is considerable traffic between this large coast town and Zacapa in the interior.

From Gualan, a town of some 6,000 inhabitants, and further up the line than Zacapa and about 138 miles from Barrios, severe sickness was reported as early as May,* it was variously styled, and appears to have gone sometimes under the name of "Railway Fever," 128 cases with 77 deaths were, it is said, reported on May 22nd.

If this were Yellow fever it would show that Guatemala was infected as early as May, and that the outbreak at Livingston might have been due to Gualan. But against this view fever was not announced at Zacapa, a little farther down the line, before June 24th, whilst it broke out at Barrios, the terminus, on June 4th. As our knowledge of the progress of Yellow fever along railway routes shows that intermediate towns often escape, it makes it all the more difficult to decide in the absence of accurate knowledge of the nature of the outbreak at Gualan, whether Yellow fever was in the interior of Guatemala prior to May 22nd, if it were, then Guatemala might have acted as a distributing centre to the coast towns.

It is very remarkable that Puerto Barrios, only 12 miles from Livingston on the coast, and the point of departure of the railway to the interior, escaped apparent infection. For it will be noticed that not only was there an exceedingly severe epidemic up the line at Zacapa and probably at other places, but fever was present at Livingston and Belize to the north, and Puerto Cortes to the south, its coast and railway communications being thus infected.

Puerto Barrios is a small village of 250 inhabitants, chiefly Jamaicans and Caribs, and within one and a-half hours' run by sea from Livingston.

* Reports reached Belize early in the year from deserting Jamaican labourers engaged upon the Barrios Railway and from other sources that severe fever, termed "Railway Fever" or *febre poludismo*, was present in the interior.

It is the sea terminal of the railroad and is a centre for the exportation of coffee, rubber and timber; a large development of the banana trade is looked forward to, as the railway enables the fruit to be run on to the jetty, alongside of which the fruit steamers are made fast.

The line which will connect the coast with Guatemala City is still under construction. When the line is completed Guatemala will possess an *Inter-oceanic Railroad*. Already that portion of the line, 74 miles long, from San José on the Pacific coast to Guatemala City has been constructed, and the line from Puerto Barrios to El Rancho (134 miles) has also been finished; there remains an intervening strip of 63 miles, which is now under construction.

It is of importance also to note that Mexico and Panama have already their Interoceanic Railroads, that Costa Rica is completing one, and as will be shown directly Spanish Honduras also aspires to an interoceanic road. These railroads, connecting the east and west coasts of Central America, must be taken into account in problems bearing upon the spread of disease from the Pacific Coast to the Atlantic, and vice versa; they are also traffic routes which materially shorten the distance from the United and Central American States to the East.

There are some 15 whites in Puerto Barrios, and their quarters are separated from the native village. I made an examination of many of the lots and found the usual large vats connected to the few public offices and large houses which exist, and very numerous barrels in the yards in the native town. The barrels contained *Stegomyia* larvæ in abundance, and I was able to identify numerous adult mosquitoes. They are as abundant in proportion as in any other coast town. It was therefore not from absence of the Yellow fever mosquito that Puerto Barrios escaped. At the time of the epidemic in the other coast towns there was a large accumulation of creosoted sleepers in Barrios for transportation up the line, and by some it is thought the smell might have acted as a mosquito destroyer, but I do not think it could have had the least effect upon the innumerable larvæ in the barrels.

There were white non-immunes in Barrios at the time, and we must attribute their escape, therefore, either to the freedom from infection of the *Stegomyia*, although only within one and a-half hours' run from Livingston, due to effective quarantine, to the partial segregation of the whites, or to the whites removing up the line for a time.

Santa Thomas lies opposite Puerto Barrios, across the bight of St. Thomas. Fruit is exported from it, but its place is now taken by Barrios with its railway. There were suspicious cases of fever present in September.

SPANISH HONDURAS.

THE PORTS: PUERTO CORTES, OMOA, TELA, CEIBA, UTILA, RUATAN AND TRUJILLO.

THE INTERIOR TOWNS: SAN PEDRO, RIO BLANCO, CHAMILICON AND CHOLOMA.

Puerto Cortes.—The principal seaport town in Spanish Honduras consists of a very narrow town, two to three lots deep, curving round the bay.

It contains some 2,500 inhabitants, including a small number of North Americans engaged in business. The port is the terminus of the proposed Interoceanic Railroad, about a third of which has been constructed. Thanks to the railroad, to the depth of water in the bay, and to the fact that the steamers can come alongside the railway wharf, there is a very large traffic in bananas brought from the interior, both Puerto Barrios and Puerto Cortes on these accounts far outstripping British Honduras.

The coasting trade is principally with Belize, Barrios and Livingston in Guatemala, and occasionally with Cuba. There does not appear to be trade with Panama.

The town is similar to the other coast towns; the houses of the principal traders are congregated toward one end of the town, but small native houses are mixed up with them, and there is no effective segregation. There is a British and an American Consul, the former issuing the Bills of Health, for ships destined for British ports. There is a Honduranian Government Medical Officer, a local Spanish doctor, and two American medical men, one of whom represents the United States Marine Hospital Service. Both these doctors took the principal share in preventing the spread of the recent epidemic in Puerto Cortes, the Honduranian Government first followed their good advice and helped them to carry out fumigation, screening and oiling, but their support did not last long. The water supply consists of rain water stored in the usual large wooden vats in the case of the larger houses, and in numerous barrels in the poorer lots, the receptacles are unscreened, and I found *Stegomyia* larvæ very abundant here as in other places. The houses are arranged in a row on each side of the line, on one side they project into the sea, on the other they are bounded by swamp. The town ought to be healthy, and with efficient sanitary control, recurrences of Yellow fever could be prevented. At the present time the place has an unkempt appearance, and there is no effective sanitary board.

The first notification of Yellow fever in Cortes was made May 25th, but there had been a very suspicious case May 22nd. Up to September the total number of cases reached 146 with 50 deaths. These figures must be taken with reserve, as it is not evident that all cases were reported, notably those amongst the soldiers. The disease first made itself manifest amongst the new arrivals, that is the non-immune white population, it then passed through the native non-immunes. Before the announcement of Yellow fever there had been very little sickness.

From Puerto Cortes it is supposed that the disease spread up the line, for there is the history of a woman who carried the infection to San Pedro, where the first secondary infection occurred. The fever started at this place on the 18th June, and the total recorded number of cases to December was 621, with 153 deaths.

San Pedro is a large city of 10,000 inhabitants, some 30 miles up the line. The medical authorities, both American (Drs. Austin and Carter) and local, have worked upon modern lines to clean up the town and limit the disease. Close to San Pedro on the line, two cases occurred at Rio Blanco. The next town farther up on the line to become badly infected

was Chamilicon, eight miles from San Pedro. The fever broke out on July 1st, and approximately there have been 160 cases with 49 deaths. Sometime in July Yellow fever was declared at Choloma; the infection was attributed to San Pedro, there were 148 cases and 59 deaths, but the disease was still reported there in the middle of November.

It is again worthy of note that between infected places on the line, intermediate towns appear to have remained free, and similarly with the Honduranian Coast towns, notably Omoa, close by Cortes, Ceiba, Truxillo, Ruatan, Utila, the fever does not appear to have broken out. The occurrence of fever along the Puerto Cortes line appears to coincide with what had taken place on the Puerto Barrios line, and the same doubts occur as to whether the disease in the interior towns was secondary to the coast town infection or not. The Cortes line is 57 miles long, and is the first segment of the Honduranian Interoceanic line to connect Puerto Cortes with Amapala on the Pacific. The dates of infection of San Pedro, Chamilicon and Choloma, if correct, shows that infection probably came from Puerto Cortes, and this would constitute another example of the way in which infection spreads by a trade route. With regard, however, to the source of the infection of Cortes itself, it is regarded as possible, for it to have reached that port overland from Gualan by the Santa Barbara trail. This is tantamount to attributing the blame to Guatemala, and to assuming that the fever in Gualan was Yellow fever.

The distribution of the population of British Honduras and of the Central American Republics are not similar. In British Honduras the population is gathered at the coast towns and the traffic is concentrated there; in the interior the population is exceedingly sparse, there are no large towns or large trade routes and the greater part is virgin territory. The surrounding Republics, on the other hand, have been long settled, the chief towns are in the interior, and there is a continuous trade between town and town and between the towns of adjacent Republics. The coast towns are of more recent development and are due to the increasing trade with foreign countries. We know comparatively little, however, of the exact disease returns of the towns in the interior, Medical Officers of the United States Public Health and Marine Service are not stationed there to report weekly. In consequence it becomes very difficult, in countries with thickly populated interiors, to exclude the possibility of infection spreading from some endemic focus in the interior to the coast towns. Considerations like these emphasise the necessity of putting the coast towns in such a sanitary position that the taking root and spreading of infectious diseases in them will in future be rendered exceedingly difficult.

NICARAGUA.

PORTS: CAPE GRACIAS, BLUEFIELDS, AND GREYTOWN.

Cape Gracias (Port Didrick?) is a small town at the extreme north-east corner of the mosquito coast; it is the port of the mining industries of Nicaragua. Fruit steamers call. No Yellow fever was reported this summer.

Bluefields is a fruit port of 2,500 inhabitants and is 534 miles distant from Belize. No cases of Yellow fever have been reported.

Greytown (San José del Norte) is at the mouth of the proposed Nicaraguan Interoceanic canal. It is not a fruit port and no Yellow fever has been reported. Yellow fever, however, was present in the interior.

COSTA RICA.

PORT : PORT LIMON.

Port Limon dates its origin from the opening of the nearly finished Interoceanic Railroad, connecting, when completed, Port Limon on the Atlantic with Punta Arenas on the Pacific, via San José. The total distance is 276 kilometres.

It is a very considerable fruit port, fruit being exported to England as well as to the United States. It is 644 miles by steam from Belize. No Yellow fever has been reported in 1905.

PANAMA.

PORTS : BOCAS DEL TORO, COLON, AND PANAMA.

The total population of the Isthmian Canal Zone is 39,684, including Colon and Panama. Traffic has followed the construction of the Interoceanic Railroad, vast numbers of labourers were congregated together in the days of the old Panama Canal, and, as is the rule when non-immunes are massed in places where Yellow fever is endemic, the latter soon becomes epidemic. At the present time the United States Panama Commission have some 1,100 employés in the Canal Zone. In April, 1905, a small outbreak of nine cases of Yellow fever occurred in Colon and Panama, resulting in three deaths, and altogether from July 1st, 1904, to April 30th, 1905, 66 cases had occurred on the Isthmus, including nine deaths, amongst the 9,100 employés of the Commission.

The total number of deaths from diseases for the first year amongst the Commission employés amounted to 12, which gives an annual rate of 15·82 per thousand. The French in their first year had a death rate of 66·80 per thousand amongst the employés.* Plague has recently been reported.

We have every reason to believe that the United States Sanitary Authorities on the Isthmus will succeed in preventing Yellow fever attacking or spreading amongst the workmen in their charge, and that they will achieve, under very difficult circumstances, one of the greatest triumphs of sanitation in modern times.

Colon and Panama.—The Atlantic and Pacific terminals of the Interoceanic Railroad are separated by a distance of 47 miles. The distance of Panama from Colon being so short, it is evident that cases of Yellow fever in the former town will cause much suspicion to be attached to arrivals from Colon at times, even when there may not be Yellow fever at that port.

* Col. Gorgas' Report of the Department of Health of the Isthmian Canal Commission for April, 1905.

I reproduce in tabular form the Yellow fever returns of Panama and Colon for 1904 and 1905, to date :—

					NUMBER OF CASES.		NUMBER OF DEATHS.	
					Panama.	Colon.	Panama.	Colon.
<u>1904.</u>								
July ...	...	...	...	...	2	...	1	...
September ...	...	...	...	...	1	...	1	...
October ...	...	...	...	...	1	...	...	...
November ...	...	...	...	...	1	1	...	...
December ...	...	...	...	...	7	...	2	...
<u>1905.</u>								
January ...	...	...	...	...	14	1	4	1
February ...	...	...	...	...	12	...	6	...
March ...	...	...	...	...	8	4	3	1
April ...	...	...	...	...	7	1	3	...
May ..	...	...	...	...	20	14	5	3
June 19th ...	...	...	...	...	29	15	5	2
July 20th ...	...	...	...	...	23	17	7	5
August ...	...	...	...	...	22	28	11	9
September ...	...	...	...	...	5	...	2	...
October ...	...	...	...	...	3	...	2	...
November ...	...	...	...	...	3 cases reported on Isthmus		...	...

These figures show that Colon was an infected port long before the outbreaks at Belize, Livingston, or Puerto Cortes. Colon is in monthly communication with Belize and is under five days' steam.

It is obvious therefore that, as long as Colon and Panama furnish cases of Yellow fever, an accurate examination of all arrivals from Colon must be made. I will refer in another place to the precautions taken previous to May 22nd, when the fever was declared in Belize against infection from Colon.

Bocas del Toro is a small town, and a centre for the exportation of fruit. A case of Yellow fever was reported on August 15th, and altogether to October some 13 cases appear to have occurred.

Until we have reliable information of the diseases which are present in the towns of the interior we cannot exclude them as a serious source of infection to the coast towns. The latter have now medical representatives of the United States who keep a watch and report the cases when they are recognised, but the interior towns are not so reported, or at all events not until disease has thoroughly established itself and it is impossible to hide it; therefore the tendency may be to regard the coast towns as the primary focus when in reality the disease has been smouldering all along in the interior. This is especially the case when the towns in the interior, as in Guatemala, Spanish Honduras and Yucatan, are of a considerable size.

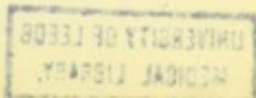
REPORTED CASES OF YELLOW FEVER IN BELIZE AND *Fruit Ports* IN COMMUNICATION WITH
BELIZE, 1904-5.

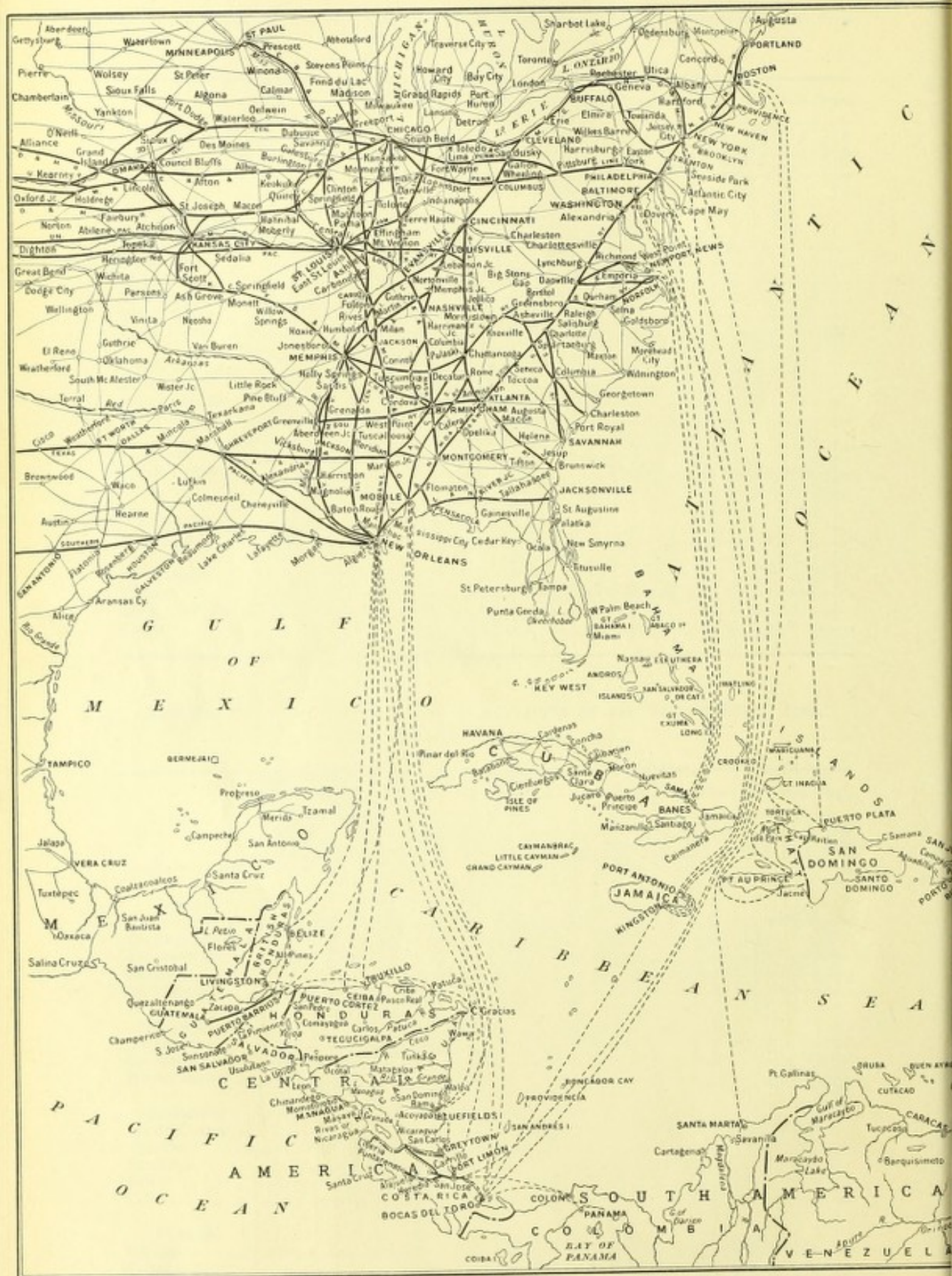
NAME OF FRUIT PORT.	1904		Aug.	Sept.	Oct.	Nov.	Dec.	1905		Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	
	July.							Jan.										
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
BRITISH HONDURAS :																		
Belize ...	...	...	...	...	...	...	...	...	...	...	...	...	6	6	4	3	...	...
Mullins River ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Stann Creek ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Monkey River ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Sennis River ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Punta Gorda ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
GUATEMALA :																		
Livingston ...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	4	11	12	
Puerto Barrios...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
San Tomas ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
HONDURAS :																		
Puerto Cortez ...	...	...	...	...	...	...	...	...	...	...	...	...	5	3	13	5	4	
Ceiba ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	11	70	29	
NICARAGUA :																		
Bluefields ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
PANAMA :																		
Panama ...	2	2	1	1	...	1	...	3	...	12	2	22	5	15	11	8	2	
Bocas del Toro ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	
Colon ...	...	...	...	...	...	2	...	1	1	1	...	3	...	2	2	7	3	

REPORTED CASES OF YELLOW FEVER AT ALL PORTS IN THE YELLOW FEVER ZONE,
COMMUNICATING WITH BELIZE, 1904-5.

PORT.	1904								1905																							
	July.		Aug.		Sept.		Oct.		Nov.		Dec.		Jan.		Feb.		Mar.		Apr.		May.		June.		July.		Aug.		Sept.			
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.		
MEXICO :																																
Vera Cruz ...	22	4	37	5	45	11	59	9	65	42	12	3	2	1	1	1	2	1	9	5	5	3	5	...	14	6	16	8	...	...		
Progreso & Merida	31	5	9	6	2	...	2	1	6	1	...	...	2	1	1	...	1	1	1	...	...	...	...	...	...	...	...	...	...	...		
Ascension Bay...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		
Xcalak ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		
Payo-Obispo.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		
GUATEMALA :																																
Livingston ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	4	11	12	...	...	...	...	
San Tomas ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Puerto Barrios...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
HONDURAS :																																
Puerto Cortez ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	3	13	5	4	11	70	29	...	...
Truxillo ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Ruatan...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Utila ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Ceiba ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
PANAMA :																																
Panama ...	...	2	2	1	1	...	...	1	...	...	...	3	...	12	2	22	5	15	11	8	2	16	3	25	6	27	11	22	10	...	...	
Colon ...	...	...	...	...	...	...	...	...	2	...	...	...	1	1	1	1	3	3	2	2	7	3	15	2	17	5	28	9	...	...		

MAP II SHOWING THE FRUIT PORTS OF CENTRAL AMERICA
& THE ROUTES FOLLOWED BY THE STEAMERS OF THE
UNITED FRUIT COMPANY





MAP II, SHOWING THE FRUIT PORTS OF CENTRAL AMERICA
& THE ROUTES FOLLOWED BY THE STEAMERS OF THE
UNITED FRUIT COMPANY.

CHAPTER IX.

THE SHIPPING TRADE OF BELIZE AND THE
RELATIONSHIP OF TRADE ROUTES TO THE DISTRIBUTION
OF YELLOW FEVER.

IN 1903, Sir Patrick Manson¹ drew attention to the risk of introducing Yellow fever into Asia by making and working the Panama Canal. He pointed out how disease followed the lines of commercial maritime travel, and the danger which would exist of transmitting infected mosquitoes.^{2 3} There is abundant proof in the past, in the days of the sailing ships, of the transference of Yellow fever from endemic *foci* in the West Indies, South and Central America, both to Southern Europe and to North America, where the fever spread over a smaller or larger area of infectible territory when the conditions of temperature and moisture were favourable to the life and development of the *Stegomyia fasciata*.

Spain was terribly ravaged by it in the early part of the 19th Century, the infection being brought from the Spanish Colonies in ships harbouring infected *Stegomyia* and breeding fresh supplies. In the same way Portugal was infected from Brazil, and Gibraltar also became infected. In France and in England ships have carried both infected mosquitoes, and cases of Yellow fever which developed on board, to their shores, but diffusion has not occurred. The history of the outbreaks of Yellow fever in Europe marks the period of active Colonial development and military expeditions to Yellow fever countries.

Since 1870, however, there has been a marked diminution in the number of Yellow fever patients brought to Europe, and this is attributed to improved ships' hygiene, and to the substitution of steam for sail. The risk of the transportation of mosquitoes for long distances by ships is becoming less. Nevertheless, there is a possibility, and I have considered it of interest to record some of the most recent evidence bearing upon the subject.

TRANSFERENCE OF MOSQUITOES BY SHIPS.

It is well known that it is often impossible to sleep on board ships without nets, when moored alongside wharfs, or standing off a small distance from shore, or whilst moored in certain rivers. In New Orleans ships alongside the wharf become severely invaded at times. Depending upon the season of the year, and the temperature, mosquitoes on board may be transferred considerable distances, especially in those places on the ship which are kept warm and free from draught. The common places described are the galley, stuffy berths, forecastle and holds.

¹ Paper read before the Epidemiological Society, 1903.

² Yellow fever in France, Italy, Great Britain and Austria, Yellow fever Institutes Bulletin, No. 8, 1902, also Bulletins 1-7, 1902.

³ *Moustiques et Fièvre Jaune*—Chantemesse et Borel, Paris, 1905.

Dr. Grubbs¹ of the U.S. Marine Medical Service made an examination extending over five months at the Gulf quarantine station, on Ship Island, of vessels arriving from *Stegomyia* infected ports. Eighty-two vessels were examined between June 1st and November 1st, of these 78 were sailing ships and four steamers. The result was as follows:—

Vessels with no mosquitoes on board at any time	...	...	...	65
Vessels with mosquitoes on board at Port of departure	...	...	...	5
Vessels on which mosquitoes appeared en route (culex)	...	...	...	9
Vessels arriving with <i>Stegomyia fasciata</i> on board	...	...	...	3

In these three cases, which were sailing vessels and were 13–20 days out, the *Stegomyia* had come on board at Vera Cruz in two instances, in all probability on the wing as no larvæ were found in the tanks; in the third case *Stegomyia* larvæ as well as the adult mosquitoes were found on board before the ship left Vera Cruz, and a plague of *Stegomyia* was found on board her on arrival at Ship Island, the water barrels breeding them in transit. It is possible, therefore, for the *Stegomyia* to invade ships at *Stegomyia* infected ports, for in ports where the wharf or anchorage is close to dwelling houses the common mosquito on the wing is the *Stegomyia fasciata*, which is breeding in every uncovered barrel and clean water receptacle in the vicinity. Moreover, if water is taken in by sailing ships it is usually taken, in the case of *Stegomyia* infected ports, from the large wooden storage vats which in all probability contain larvæ. Dr. Carter,² during his Ship Island quarantine experience of three years up to 1894, gives the history of 13 vessels (these appear to be all sailing vessels) chiefly from Rio de Janeiro, in which Yellow fever developed on board. He is of opinion that since 1893 such vessels are much rarer owing, amongst other reasons, to the substitution of steam for sail. Rosenau reported a case of Yellow fever contracted on a steamship in 1899, and in 1900 a steamship from Bocas del Toro (fruit port) developed three cases, seven, eight and nine days out. In the records of the Marine Hospital Service there are numerous other direct observations of the transmission and development of the *Stegomyia fasciata* on board ships.^{3 2} So that it may be taken as proved that ships can act as carriers, but not to the same extent as formerly.

Mosquitoes in Baggage:—In considering this question of the transference of Yellow fever by trade routes, the possibility of baggage conveying the *Stegomyia fasciata* has to be considered. The conclusion (Reed and Grubbs) is that in a dry state, in baggage, the *Stegomyia* will not survive more than two or three days. Dr. Grubbs points out that they may, however, survive much longer in the presence of moisture. Dr. Souchon, President of the Louisiana State Board of Health and Dr. Gill from experiments also agree with the statement.

Transference of Yellow fever cases by the Fruit and other Steamers trading with Gulf and Fruit Ports:—Steamers arriving from infected ports may carry passengers or crew who develop Yellow fever in transit or on arrival. Dr. Souchon, on observations extending over 15 years from 1886, that is, from the date of commencement of the fruit industry between New Orleans and

¹ Bulletin No. 11 Yellow Fever Institute, Washington, 1903.

² Yellow Fever Institute Bulletin No. 9, Washington, 1902.

³ See also for considerable record, "Fruit Vessels, Mosquitoes and Yellow fever." Dr. E. Souchon. Journal of American Medical Association, June, 1903.

the Central American fruit ports, states that out of a total of 1,260 trips, the following five cases occurred on board.

July, 1887, "City of Dallas" from Belize	...	...	...	...	1 case
August, 1888, "Foxhall" from Limon	...	...	...	...	1 case
October, 1889, "City of Dallas" from Livingston	...	...	...	...	1 case
October, 1897, "Jari" from Bocas del Toro	...	...	...	...	1 case in quarantine and 24 in the City
August, 1900, "Adler" from Limon	...	...	...	...	1 case

Now all these ports had Yellow fever in those years, and the run is under five days.

During the present year (1905) the following cases, all members of the crew, were taken from ships entering the Mississippi.

July 11th, S.S. "Royal Exchange" from Colon (via Mobile)	...	...	...	1 case
July 12th, S.S. "Sapphir" from Colon	...	...	...	1 case
August 6th, "S.S. "Texan" from Vera Cruz	...	...	...	1 case
August 15th, S.S. "Puerto Rico" from Vera Cruz	...	...	...	1 case
August 20th, S.S. "Sapphir" from Colon	...	...	...	3 cases
September 1st, S.S. "Origen" from Colon	...	...	...	1 case
October 26th, S.S. "City of Tampico" from Vera Cruz...	...	...	...	1 case
October 27th, S.S. "St. Croix" from Vera Cruz...	...	...	...	1 case

There is, therefore, no question that in infected places infected persons can be taken on board, and that unless there is strict and careful quarantine such cases may infect infectible places on arrival or infect the *Stegomyia* if it is on board, which in its turn may infect dock labourers, Custom House officials, or pass to shore and spread infection, just as would happen if infected mosquitoes were taken on board.

Sea Trade of Belize with United States, Mexico and Central American Republics.—In order to determine the amount of intercourse by ships between Belize and the neighbouring States, with the object of throwing light upon the recent epidemic, assuming that the chances of infection were proportional to the number of sailings, I asked Mr. Walcott, the Collector of Customs, to furnish me with tables of the number, tonnage and crews of steam and sailing vessels entered at British Honduras in the years 1902, 1903, 1904 and 1905 to September of this year, he has kindly done so, together with a memorandum on the sea trade, which I reproduce.

Summarising the tables it will be seen that the total number of steamships is less than the total number of sailing ships, and that, whilst the greatest number of steamships comes from the United States, followed by Guatemala and Honduras, the sailing ships from Mexico, Honduras and Guatemala are much more numerous, viz. :—

STEAMSHIPS.					SAILING VESSELS.				
United States	...	...	...	395	Mexico	...	...	...	1,076
Guatemala	...	...	...	292	Honduras	...	...	...	739
Honduras	...	...	...	197	Guatemala	...	...	...	228
Mexico	...	...	...	74	United States	...	...	...	23
Nicaragua	...	...	...	11	Nicaragua	...	...	...	5

Very significant is the fact that the total number of sailing ships from Mexico were largely in excess of other neighbouring States from January to September, 1905. Given the presence of Yellow fever in or around the port from whence the ships came, then the chances of infection from Mexico are greater than from other States. In a preceding chapter I have shown that Yellow fever is endemic in Mexico, and that there are numerous foci.

TOTAL NUMBER, TONNAGE AND CREWS OF STEAM VESSELS ENTERED AT BRITISH HONDURAS
FOR THE PERIOD 1902 TO SEPTEMBER, 1905.

	WITH CARGOES.			IN BALLAST.			TOTAL.		
	Ves.	Ton.	Crews.	Ves.	Ton.	Crews.	Ves.	Ton.	Crews.
NORTH AMERICA.									
United States ...	362	274,718	10,493	33	29,414	722	395	304,132	11,215
CENTRAL AMERICA. (NORTH AMERICA)									
Mexico ...	27	1,105	194	47	12,675	492	74	13,780	686
Honduras ...	97	68,956	2,984	100	71,744	2,854	197	140,700	5,838
Guatemala ...	115	80,364	2,713	177	95,667	3,291	292	176,031	6,004
Nicaragua ...	5	8,502	154	6	10,636	195	11	19,138	349
WEST INDIES.									
Bahamas ...	...	...	...	5	9,525	137	5	9,525	137
Trinidad ...	5	8,130	171	3	4,748	95	8	12,878	266
Bermuda ...	...	...	...	1	1,168	26	1	1,168	26
Guadalupe ...	1	1,607	29	...	...	...	1	1,607	29
Cuba ...	...	...	...	3	3,270	60	3	3,270	60
St. Lucia ...	1	1,067	29	2	2,988	60	3	4,055	89
Jamaica ...	...	...	...	2	1,396	31	2	1,396	31
Barbadoes ...	...	...	...	4	5,916	101	4	5,916	101

NUMBER, TONNAGE AND CREWS OF STEAM SHIPS ENTERED AT BRITISH HONDURAS IN THE
YEARS 1902, 1903, 1904, AND TO SEPTEMBER, 1905, RESPECTIVELY.

	WITH CARGOES.			IN BALLAST.			TOTAL.		
	Ves.	Ton.	Crews.	Ves.	Ton.	Crews.	Ves.	Ton.	Crews.
NORTH AMERICA.									
United States, 1902	98	62,849	2,693	5	3,606	99	103	66,455	2,792
" 1903	111	84,673	3,113	11	11,670	267	122	96,343	3,380
" 1904	99	78,661	2,916	9	9,182	186	108	87,843	3,102
" to Sept., 1905	54	48,535	1,771	8	4,956	170	62	53,491	1,941
CENTRAL AMERICA.									
Mexico, 1902	1	76	8	22	2,996	193	23	3,072	201
" 1903	8	351	46	18	6,259	208	26	6,610	254
" 1904	6	323	54	4	1,797	52	10	2,120	106
" to Sept., 1905	12	355	86	3	1,623	39	15	1,978	125
Honduras, 1902	20	14,358	728	16	14,068	481	36	28,426	1,209
" 1903	25	12,582	612	22	19,080	683	47	31,662	1,295
" 1904	26	18,818	831	58	37,843	1,652	84	56,661	2,483
" to Sept., 1905	26	23,198	813	4	703	38	30	23,901	851
Guatemala, 1902	18	12,196	531	59	31,171	1,242	77	43,367	1,773
" 1903	34	22,681	838	64	31,745	1,020	98	54,426	1,858
" 1904	17	9,160	292	40	21,930	673	57	31,090	965
" to Sept., 1905	46	36,327	1,052	14	10,821	356	60	47,148	1,408
Nicaragua, 1902	1	238	15	1	2,287	32	2	2,525	47
" 1903	...	...	...	1	385	15	1	385	15
" 1904	...	...	...	4	7,964	148	4	7,964	148
" to Sept., 1905	4	8,264	139	...	...	...	4	8,264	139

NUMBER, TONNAGE, AND CREWS OF STEAM SHIPS ENTERED AT BRITISH HONDURAS IN THE
YEARS 1902, 1903, 1904, AND TO SEPTEMBER, 1905, RESPECTIVELY—*continued.*

		WITH CARGOES.			IN BALLAST.			TOTAL.		
		Ves.	Ton.	Crews.	Ves.	Ton.	Crews.	Ves.	Ton.	Crews.
WEST INDIES.										
Bahamas,	1903	..	...	...	4	7,590	109	4	7,590	109
"	1904	...	...	...	1	1,935	28	1	1,935	28
Trinidad,	1903	...	...	...	1	1,873	36	1	1,873	36
"	1904	1	1,608	30	1	1,268	28	2	2,876	58
" to Sept.,	1905	4	7,522	141	1	1,607	31	5	9,129	172
Bermuda,	1903	...	...	...	1	1,168	26	1	1,168	26
Guadalupe,	1904	1	1,607	29	...	...	...	1	1,607	29
Cuba,	1903	...	...	...	1	1,349	22	1	1,349	22
"	1904	...	...	...	2	1,921	38	2	1,921	38
St. Lucia,	1903	...	...	...	1	1,137	26	1	1,137	26
"	1904	1	1,067	29	2	1,851	34	3	2,918	63
Jamaica,	1904	...	...	...	1	1,097	23	1	1,097	23
" to Sept.,	1905	...	...	...	1	299	8	1	299	8
Barbadoes,										
to Sept.	1905	...	...	...	2	4,520	70	2	4,520	70

TOTAL NUMBER, TONNAGE AND CREWS OF SAILING VESSELS ENTERED AT BRITISH HONDURAS
FOR THE PERIOD 1902 TO SEPTEMBER 30TH, 1905.

	WITH CARGOES.			IN BALLAST.			TOTAL.		
	Ves.	Tons.	Crews.	Ves.	Tons.	Crews.	Ves.	Tons.	Crews.
NORTH AMERICA.									
United States ...	22	2,691	132	1	260	8	23	2,951	140
CENTRAL AMERICA.									
Mexico	577	7,754	1,389	449	4,004	767	1,026	11,758	2,156
Honduras	441	13,085	1,546	298	6,106	860	739	19,191	2,436
Guatemala	84	1,763	284	144	1,867	389	228	3,630	673
Nicaragua	5	76	21	...	...	...	5	76	21
SOUTH AMERICA.									
Brazil	...	...	...	17	6,377	147	17	6,377	147
Venezuela	...	...	...	3	982	25	3	982	25
WEST INDIES.									
Cuba	1	199	5	2	253	12	3	452	17
Barbadoes	3	1,158	30	5	2,097	48	8	3,255	78
Bermuda	...	...	...	1	429	9	1	429	9

NUMBER, TONNAGE AND CREWS OF SAILING VESSELS ENTERED AT BRITISH HONDURAS DURING
THE YEARS 1902, 1903, 1904, AND TO SEPTEMBER, 1905, RESPECTIVELY.

	WITH CARGOES.			IN BALLAST.			TOTAL.		
	Ves.	Ton.	Crews.	Ves.	Ton.	Crews.	Ves.	Ton.	Crews.
NORTH AMERICA.									
United States, 1902	5	475	33	...	...	...	5	475	33
" 1903	9	1,165	54	...	...	...	9	1,165	54
" 1904	5	817	30	...	...	...	5	817	30
" to Sept., 1905	3	234	15	1	260	8	4	494	23
CENTRAL AMERICA.									
Mexico, 1902	94	950	274	143	1,246	321	237	2,196	595
" 1903	146	2,402	396	115	1,195	235	261	3,597	631
" 1904	135	2,579	442	51	1,038	99	186	3,617	541
" to Sept., 1905	202	1,823	277	190	525	112	392	2,348	389
Honduras, 1902	104	2,994	339	44	980	124	148	3,974	463
" 1903	137	3,854	468	77	1,542	195	214	5,396	663
" 1904	144	3,864	531	120	2,221	327	264	6,085	858
" to Sept., 1905	56	2,373	238	57	1,363	214	113	3,736	452
Guatemala, 1902	38	1,074	153	69	843	174	107	1,917	327
" 1903	36	575	106	57	771	167	93	1,346	273
" 1904	10	114	25	12	177	32	22	291	57
" to Sept., 1905	...	...	...	6	76	16	6	76	16
Nicaragua, 1902	...	...	...	1	6	3	1	6	3
" 1903	4	66	18	...	...	...	4	66	4
" 1904	1	10	3	...	...	...	1	10	3
" to Sept., 1905	...	...	...	...	...	...	...	...	...
SOUTH AMERICA.									
Brazil, 1903	...	...	...	11	4,165	96	11	4,165	96
" 1904	...	...	...	4	1,411	33	4	1,411	33
" to Sept., 1905	...	...	...	2	801	18	2	801	18
Venezuela, 1902	...	...	...	2	670	16	2	670	16
" 1903	...	...	...	...	...	...	...	...	...
" to Sept., 1905	...	...	...	...	...	...	...	...	...
WEST INDIES.									
Cuba, 1902	...	...	...	1	165	6	1	165	6
" 1903	...	...	...	...	...	...	...	...	...
" 1904	...	...	...	...	...	...	...	...	...
" to Sept., 1905	1	199	5	1	88	6	2	287	11
Barbadoes, 1902	2	765	20	1	474	10	3	1,239	30
" 1903	...	...	...	2	852	18	2	852	18
" 1904	1	393	10	2	753	20	3	1,146	30
" to Sept., 1905	...	...	...	...	...	...	...	...	...
Bermuda, to Sept., 1905	...	...	...	1	429	9	1	429	9

NOTE ON THE SHIPPING RELATIONSHIPS WITH UNITED STATES, GUATEMALA,
HONDURAS, PANAMA AND MEXICO.¹

United States-New Orleans.—The United Fruit Company's mail steamer arriving at Belize every Sunday, and leaving Belize for New Orleans every Friday, after having proceeded to Puerto Cortes in Spanish Honduras,

¹ This was contained in a memorandum furnished to me by Mr. Walcott, Collector of Customs.

touching on the way there and back at various points on the coast of the Colony and Puerto Barrios and Guatemala. The mail steamer brings mails and cargo and returns with fruit taken on board at Puerto Cortes (Spanish Honduras), Puerto Barrios (Guatemala), and Monkey River, All Pines, and Stann Creek, in the Colony.

The United Fruit Company's cargo steamer arriving at Belize every fortnight (Wednesday), and leaving Belize for New Orleans the following Saturday, after having taken fruit at Livingston, Puerto Barrios, and Santa Tomas, in Guatemala, and Sarstoon, Punta Gorda, Sennis River, Stann Creek and Mullins River in the Colony.

NOTE.—On August 4th the S.S. "Origen" arrived at Colon from New Orleans with a case of Yellow fever on board. The ship had been four days at the docks in New Orleans.

MOBILE.

The Orr Laubheimer Company's cargo steamer arriving at Belize every other Wednesday to that of the United Fruit Company's cargo steamer, and leaving Belize the following Saturday, after having loaded with fruit at the same ports touched at by the United Company's cargo steamer.

From April to November in each year no passengers are allowed to travel by the mail and cargo steamers between the ports of the Colony and the ports in Guatemala and Spanish Honduras, with the exception of those ports where the Medical Officers of the Louisiana Board of Health are stationed, viz. : Belize, Livingston, and Puerto Barrios, in Guatemala, and Puerto Cortes in Spanish Honduras. The mail and cargo steamers take on board at Belize between 30 and 40 labourers each trip to handle the cargo discharged and fruit taken in on their voyage to Guatemala and Spanish Honduras. These labourers are landed at Belize on the return of the steamers.

There is no other communication with ports in the United States with the exception of an occasional vessel bringing lumber from Pensacola, or carrying mahogany and logwood to New Orleans, Norfolk, Boston and Stamford, Connecticut.

GUATEMALA AND SPANISH HONDURAS.

LIVINGSTON, PUERTO BARRIOS, SAN TOMAS, PUERTO CORTES, CEIBA,
UTILLA, RUATAN, TRUXILLO.

In addition to the regular communication provided by the mail and fruit steamers as described above, there is constant communication between the Colony and the ports mentioned above, by small sailing vessels and small steamers, engaged in conveying from Belize goods in transit for those ports and returning with cattle, &c. There is also constant communication by means of small doreys and fishing vessels not only between the ports mentioned above, but with a number of small settlements on the coast of Guatemala and Spanish Honduras.

PANAMA.

COLON.

The only communication with Colon is by the Harrison Line of steamers, one of which arrives in Belize monthly, after having in almost every case touched at Colon on the way from Liverpool.

MEXICO.

VERA CRUZ, PROGRESO, ASCENSION BAY, XCALAK, PAYO-OBISPO.

The ports of Ascension Bay, Xcalak and Payo-Obispo, obtain a large portion of their supplies from the Colony, and consequently there is almost daily communication by small sailing craft between these ports, Belize, Corosal, and the Cays, from whence they also obtain their supply of fish. There has been little direct communication with Vera Cruz and Progreso owing to these ports having been declared infected ports by this Government in July, 1900, and July, 1903, respectively. The port of Xcalak, however, I am informed, was made a transit station for troops, passengers, labourers and merchandise from Vera Cruz and Progreso for Payo-Obispo and the settlements and camps on the Mexican side of the Rio Hondo, so that there has been daily indirect communication with the ports in question via Xcalak and Payo-Obispo.

With the exception of vessels arriving from time to time, generally from the West Indies, to load mahogany and logwood for the United Kingdom and the United States, the above is a full account of the shipping calling at the several ports of the Colony. (H. B. Walcott.)

RAILWAY TRAFFIC AND THE SPREAD OF YELLOW FEVER.

British Honduras has as yet no railroad, but should one be constructed, the following observations, gathered from the surrounding States, will serve to show the wisdom and necessity of taking beforehand the simple precautions which science has shown to be necessary to prevent the introduction of Yellow fever into the interior.

Mr. Howard of the Agricultural Bureau, who has the largest experience of the distribution of mosquitoes in America, regards the railroads as the principal distributors of mosquitoes, and instances places to which mosquitoes have penetrated owing to the construction of railways—mosquitoes readily infest the carriages, and may be transported hundreds of miles. The rigid screening of the railway carriages in the Southern States this year was the outcome of the knowledge of the readiness with which mosquitoes enter the trains.

The two most interesting examples of the railroad distribution of Yellow fever this year are furnished by Guatemala and Spanish Honduras. In Guatemala Yellow fever broke out with great severity at Zacapa, 103 miles from Barrios, some 20 days after the outbreak at Livingston, which is close to Barrios. In Spanish Honduras the fever extended up the line from Puerto Cortes to San Pedro Sula, where it broke out some 27 days afterwards; it then extended to Rio Blanco, Chamilicon and Choloma. The epidemics in these places were exceedingly severe.

At the termini of the Panama railroad, Colon and Panama, Yellow fever is present. It has been reported at the termini of the Mexican Isthmian Inter-oceanic Railway at Tehuantepec and Coatzacoalcos. At Port Limon and San José, the terminals of the Costa Rican Inter-oceanic Railroad, no cases have been reported this year. With the completion of the Guatemalan and Honduranian railroads there will be at least five inter-oceanic railways which may readily serve as distributors of Yellow fever from the Atlantic side to the Pacific side, and conversely, perhaps, for the introduction of plague from the Pacific to the Atlantic side. There is every reason, therefore, why international action should be taken to minimise in time the risk of the distribution of these diseases. Further instances of the spread of *Stegomyia* and Yellow fever is given by Drs. Parker, Beyer and Pothier of the recent Yellow fever working party at Vera Cruz, 1903. During the construction of the railway connecting Vera Cruz with Mexico City, Yellow fever broke out amongst the employés; at the time it was unknown in the interior, but was endemic at Vera Cruz. Some nine years previous to 1903, Yellow fever had broken out for the first time at Cordoba, and had become epidemic 3,000 feet above sea level. Three years ago the fever appeared at Orizaba and became epidemic in 1902. These epidemics they attributed to the gradual distribution of the *Stegomyia*. Along the line of Mexican inter-oceanic railway they have demonstrated that the *Stegomyia* has been ascending from station to station until it has reached Corosal, 3,000 feet above sea level.—Following the ascent of the mosquito, Yellow fever has broken out in these places. Jalapa, on the other hand, a city of some 35,000 people, and 20 miles beyond Corosal and at an elevation of 4,500 feet, is free, and Yellow fever has not appeared there, although cases have been sent there from Vera Cruz and intermediate stations.

THE INTER-OCEANIC CANAL AND THE DISTRIBUTION OF YELLOW FEVER.

The experience of the French attempt to construct the Panama Canal demonstrates the rapidity with which Yellow fever followed the workmen. At the present time it will only be by the exercise of the most vigilant anti-Yellow fever sanitation that Yellow fever will be extinguished, and that any possible risk of infecting Asia, on which Sir Patrick Manson lays such stress, will be prevented.

CHAPTER X.

QUARANTINE ADMINISTRATION IN BRITISH HONDURAS.

IN spite of failure, experience has shown the value of properly organised quarantine. The United States and the West Indian Sanitary Authorities, as the result of the most recent investigations in Yellow fever prophylaxis, are not relaxing quarantine, but in the light of fresh knowledge they are making it more efficient, and at the same time less onerous for travellers and shipowners. The attitude of the United States towards quarantine at the present time is that it is "absolutely necessary both to preserve commerce and on the score of humanity," and that "modern scientific quarantine is nothing more than the sanitation of ships."—Wyman. It has also, however, been fully recognised that side by side with quarantine a determined effort must be made to get rid of endemic foci of quarantinable diseases, and to protect by local measures those places which by reason of their geographical position, commerce or insanitary condition are liable to infection. Due entirely to the recent brilliant scientific investigations in the mosquito-borne diseases and to our knowledge of plague, quarantine is becoming simplified and organised as a part of the machinery to exterminate the quarantinable diseases not from one State only, but from all communicating centres in any particular fever zone. Modern quarantine, as put forth at the recent International Pan-American Convention (1905), imposes the minimum restriction on trade compatible with security; further, as the *sanitary soundness* of the particular State which may have to be quarantined will be a very considerable factor in guiding the other neighbouring countries in carrying out the necessary quarantine, a powerful stimulus is given to any place liable to infection by reason of its position, commerce or mal-sanitation to carry out the comparatively simple local sanitary measures of reform which recent investigations have proved to be efficacious in not only stamping out disease but, as in the case of Yellow fever, rendering the place immune.

In framing quarantine regulations for British Honduras it is necessary in the first instance to consider the following data.

A.—Geographical Position.—It is in the Yellow fever zone. The *Stegomyia fasciata* is the common domestic mosquito and breeds all the year round, and Yellow fever has occurred throughout the year. The Colony is, therefore, vulnerable in any month.

The Colony is surrounded by States in which Yellow fever is either endemic or liable to occur, and in which *Stegomyia fasciata* is known to be the common domestic mosquito.

B.—Commercial Relations.—In the chapter devoted to the "Relationship of Trade Routes to the distribution of Yellow fever" I give tables showing the volume of our trade with the neighbouring Republics, and I record instances of the occurrence of Yellow fever on ships trading between the Central American ports.

In the chapter devoted to "Yellow Fever in the Central American Republics, and in Mexico with Special Reference to the Fruit Ports," I give a brief account of the prevalence of Yellow fever in Mexico, Panama and Central American Republics during this year, and tables showing the ports either within five days' steam or sail from Belize, in which Yellow fever is endemic or liable to occur.

C.—Sanitary Administration.—Under this head must be taken into account the sanitary control maintained in those countries with which the Colony trades, and, secondly, the state of sanitation in the Colony itself. In connection with the first I have already indicated in a short chapter devoted to "Sanitary Control in Mexico and the Central American Republics" the extent of sanitary control at the principal ports. With the encouragement which the United States is giving to Central American sanitation, and as the result of the recent Convention at Washington, there is reason to hope that anti-Yellow fever measures will be adopted similar to those which have been carried out at Havana, New Orleans and Vera Cruz. But it will probably be some time before sanitary control will be deemed efficient in many of the ports, and in these instances quarantine measures will have to be framed to meet the particular cases.

With regard to the sanitary administration of the Colony, it will become clear from this Report that not only is the sanitary administration of the Colony more efficient than in the surrounding Republics, but also that it is most practicable to render the principal ports in the Colony non-labile to Yellow fever.

If in addition to the above considerations it were now possible, since the Washington Convention of this year, to procure from neighbouring States the additional knowledge referred to in the commencing articles of this Convention, viz. :—

1. Immediate notification of quarantinable disease,
2. Prophylactic measures used against fever,
3. Weekly health returns,

the framing of quarantine regulations could be made uniform. It would be unwise, however, to rely at the present time on obtaining these data from all the Republics.

In discussing quarantine administration in the United States (Ch. XI.) the machinery whereby the Government of that country seeks to ascertain the sanitary soundness of the countries with which it trades will be seen to be very complete. We have no such medical organisation in the neighbouring Republics, and we must rely upon the Consular Service. Of great use are the weekly Bulletins of the Public Health and Marine Hospital Service of the United States, and the weekly Health Reports furnished by the Mexican Government.

It is evident, both on account of its geographical position with "suspects" on either side and on account of its commercial relations, that quarantine is indispensable to British Honduras. It remains therefore to make it efficient in the light of recent knowledge, and at the same time to cause as little unnecessary delay to traffic as possible. The argument is sometimes put forward against the expense and uselessness of maintaining quarantine. British Honduras, in the

midst of the Yellow fever zone, communicating with Yellow fever ports, and with countries in two of which plague has been declared, cannot use such an argument. Its quarantine system should be regarded as part of the necessary insurance against the invasion of disease, and as an index to other powers of the efficiency of the sanitary administration of the Colony.

I.—RECOMMENDATIONS.

For clearness I will divide recommendations under the following heads :—

1. Improvement in the notification of disease in foreign ports, in Bills of Health and in furnishing health returns for foreign ports.
2. Improvement in medical equipment and inspection at the ports of entry in the Colony.
3. Improvements in quarantine accommodation.
4. Provision for isolation of quarantinable diseases.
5. Alteration in the quarantine regulations to bring them up to date.

(A.) *Early Notification of Quarantinable Diseases in Foreign Ports.*—British Honduras labours under the grave disadvantage that it is not yet in telegraphic communication with Jamaica or with the neighbouring Republics, with the exception of Mexico with which there is partial communication. The first intimation of sickness in a port may be contained in the Bill of Health of the ship which arrives.

British Consuls at all ports having commercial relationship with British Honduras, and whether quarantinable disease is present or not, should furnish, on forms to be prepared, a weekly statement of the health of the port, including the presence or absence of quarantinable diseases in the port itself, and any information relating to quarantinable disease at other places in the State. The weekly returns should be sent to the Governor of the Colony.

Upon the first intimation of a quarantinable disease the Consul should telegraph, or otherwise despatch by the quickest route, information to the Governor of the Colony.

The recent epidemic in Central America has thrown into prominence faults in the Consular organisation as regards notification of disease. Whilst the American Consuls have the advantage of an official medical adviser, our Consuls have to rely largely on their own judgment. It is essential, therefore, that they should be officially posted with the most recent information bearing upon the quarantinable diseases both as to cause of origin, method of spreading, and prophylaxis. In my travels down the Central American coast I was asked by a Consul to recommend him a suitable book in which to read up the subject of Yellow fever. In connection especially with this disease and with plague official information could with advantage be furnished to the Consuls. Consuls should also be in a position to report upon the sanitary state of the port with reference to quarantinable diseases, and they should place themselves in positions where they would be likely to obtain early information of disease. Experience points out that the loss of lives and of commerce is occasioned not by premature reporting, but by the concealment of early cases. In quarantine organisation the initial reform lies in immediate reporting.

(B) *Bills of Health*.—It is evident from the experience of 1905 that fresh instructions should be issued concerning them. At a meeting of the Quarantine Board held at Belize on October 18th, the Hon. H. B. Walcott, Collector of Customs, President, in the chair, it was resolved that the Foreign Office be approached with the view of instructions being issued to Consular Officers to state on Bills of Health the date of the termination of the last case of quarantinable disease at the ports for which they are issued. This information is essential to carry out Article IX. of the Washington Convention, 1905 (Ch. XI.). That misunderstanding may occur is made evident by the fact that it was "not known (at Belize early this year) that Yellow fever was also present in Colon during 1904 and the early part of 1905, against which port no precautions whatsoever were taken owing to clean Bills of Health having been issued by the British Consul to all vessels arriving from the Port."

In a communication from the British Consul at Puerto Cortes, dated October 10th, 1905, it is stated: "No cases to report (last case died September 29th), although as trains are running daily with general freight and bananas through infected points, I cannot see how I can give clean Bills of Health until the line of railway is declared perfectly free of disease, under these circumstances I would suggest that all vessels, big or small, leaving the port should be obliged to present British Bills of Health."

Guidance in a case like this would be furnished by Article VIII. of the Washington Convention, 1905.

(c) *Health Returns of Foreign Countries*.—In addition to the weekly returns to be furnished by Consuls, I recommend that the following weekly and periodical Health Reports be immediately procured and filed by the Quarantine Board.

1. The weekly Public Health Reports of the Public Health and Marine Hospital Service of the United States.
2. The weekly and periodical reports issued by the Supreme Board of Health of Mexico.
3. The monthly reports of the Department of Health of the Isthmian Canal Commission.
4. The Health Reports of Havana.
5. Reports of other Central American Republics, if they are published.

These reports are of great importance as they contain information directly affecting British Honduras. It should be the duty of the Medical Officer in charge of the quarantine to lay a summary of the reports, in so far as they affect British Honduras, regularly before the Board.

2.—IMPROVEMENTS IN MEDICAL EQUIPMENT AND IN INSPECTION AT THE PORTS OF ENTRY INTO THE COLONY.

For the work of the Medical Officer of the quarantine to be effective it is necessary:—

(A) That the routine examination of ships be systematic. That the temperature and pulses of crews and passengers be taken in the case of

arrivals from infected or suspected districts, and that a résumé of all examinations be recorded in an official diary kept for the purpose.

(B) That there should be as little delay as possible before making the inspection, so that no ship is unnecessarily detained.

(C) That if fumigation is necessary, it be carried out properly. That the right proportion of sulphur or carbolic-camphor to be employed be properly gauged, and that the chambers be properly sealed.

(D) That the Medical Officer make examination of all water casks or other water receptacles on sailing craft, to determine the presence or absence of *Stegomyia* larvæ. (Masters of sailing craft should be instructed to keep all drinking water receptacles properly screened.)

(E) That the Medical Officer be provided with a room, either at the quarantine station or at the general hospital, for the purpose of making blood and urine examinations, and that he be provided with a microscope, stains and accessories.

(F) It is most desirable that every Medical Officer in charge of quarantine should have some practical knowledge of, and be able to recognise, the quarantinable diseases. Plague has not yet appeared in British Honduras, but it would tend to security if the quarantine officer were given the opportunity of seeing cases at some place where the disease was present. Every epidemic of Yellow fever shows that the most valuable time is lost by practitioners not recognising the early cases.

(G) *Fees.*—As in the case of the Federal quarantine in the United States no fees should be charged for inspection and disinfection. Fees fall heavily on small craft, and as a great deal of the trade in British Honduras is carried out by small sailing vessels, trade is injuriously affected.

(H) *Medical Inspection at Corosal, Punta Gorda and Stann Creek.*—The Medical inspection at these ports in the Colony should be as systematic and conducted in the same manner as at Belize.

The Medical Officers at Corosal and Punta Gorda should visit from time to time, upon receipt or rumour of disease upon their respective frontiers, the adjacent towns. The Medical Officer at Corosal should be acquainted with the health conditions obtaining at Xcalak, Payo-Obispo, Bacalar or other places on his frontier. The Medical Officer for Punta Gorda in the same manner should from time to time visit Livingston and Puerto Barrios and make himself acquainted with the health conditions at these points and places on the line of railway. There should be a medical officer stationed at Stann Creek.

These three places are vulnerable ports in the Colony, and the same prophylactic measures which are put in force in Belize will have to be applied to them if trade is to be encouraged.

The medical officers charged with the inspection of shipping and traffic at Punta Gorda, Stann Creek, Corosal, Orange Walk, or at any other point in the Colony, should report weekly to the Quarantine Board, and should receive weekly from the Board copies of the digest of the Health Reports of the neighbouring Republics prepared for the Board by the quarantine officer at Belize (see ante).

At the present time, as before pointed out, the medical officers at Punta Gorda and Corosal are isolated and not sufficiently in touch with Belize or with what is taking place in the adjacent Republics.

(1) The medical officers at the ports should have strict orders to report any case, suspicious or clearly marked, at once by telegraph or telephone to the Medical Officer-in-chief at Belize, who should immediately acquaint the Quarantine Board, and should proceed at once to the port to consult with the officer, and in case of death hold the post-mortem.

Medical officers should be encouraged to act promptly and fearlessly in this matter, although owing to inexperience they may confound a pernicious Malaria case with one of Yellow fever.

(J) *Issuing of Bills of Health from Additional Ports in the Colony.*—In July, 1903, the Collector of Customs asked that Corosal, Stann Creek and Punta Gorda be allowed the privilege of issuing Bills of Health to ships clearing from their ports, so that ships should not be obliged to proceed to Belize to clear. If, in the opinion of those most capable of judging of the trade of the Colony, the issuing of such Bills would encourage trade, there is no reasonable ground for withholding the privilege if, as recommended above, there is an organised medical inspection at the three ports, Corosal, Stann Creek and Punta Gorda. No Bill would be issued except after the official medical inspection as at Belize, and a foul Bill would not be issued as the result of inexperience in diagnosis because it would have been necessary for the Chief Medical Officer (see above) to have seen the case.

From Article VIII. of the Washington Convention, 1905, there may be an advantage in having more than one medically organised port. A case of Yellow fever occurring at Corosal or Punta Gorda might not necessarily imply that the whole Colony of British Honduras, including its principal port at Belize, would be declared infected thereby, if, for example, it could be shown to the satisfaction of the United States that every reasonable precaution was taken to limit and stamp it out.

3.—IMPROVEMENTS IN QUARANTINE ACCOMMODATION.

It is not the purpose of this report to examine what has taken place in the past. It is sufficient to know that unfortunately in too many instances any accommodation has been thought good enough for quarantined passengers, and that in some places no accommodation whatever exists, and small sailing craft with sick on board, and with no proper accommodation, are often compelled to complete their quarantine far from shore or else proceed elsewhere. (See chapter on Corosal, &c.)

The modern principle of quarantine is still misunderstood. As stated in the commencement of this chapter, modern quarantine is little more than the sanitation of ships, and like the sanitation of towns it is to be performed rationally, humanely, and with as little interference with business as possible. In this respect the Louisiana State Board of Health, owing to the action of the United Fruit Company, early made a step in advance, and the quarantine sheds were replaced by a proper quarantine hotel. If, in addition to the natural difficulties of commercial progress in tropical countries, there are added

the discomfort of being confined a prisoner for several days in a dilapidated building, made to house all classes of travellers at the same time and without distinction of class, and rendered dangerous by reason of no precaution whatever against mosquitoes, malarial or Yellow fever, no wonder that a Colony gets a bad reputation and the commercial man keeps away.

British Honduras, on account of its position, its commercial relations, and from the fact that it has just recovered from an outbreak of Yellow fever, cannot afford to be without a well-organised station, although that station may be hardly ever used.

I recommended as a matter of urgency that the present quarantine station, together with the adjoining premises known as the "married men's quarters," be put into proper repair and got ready for the reception and division of first, second, and third class passengers. That the buildings be properly screened, and that as much of the marsh land around as possible be filled in. I understand that the money necessary for these alterations and additions was voted by the Legislative Council. But that is not enough, the station will require looking after and must not be allowed to fall into disrepair.

The situation of the present quarantine station (see Figs. 19 and 20) is the best available site, it is unfortunately surrounded by much swamp, but if the sand pump advocated by the Superintendent of Public Works be introduced, as great an improvement can be brought about as has occurred in many towns where the sand pump has been used. Much of the swamp at the present time affords breeding ground for *Anopheles* (see mosquito map). In addition, the quarantine buildings are a reasonable distance away from the town. (See Plan III.)

I strongly urge that whilst passengers are detained their comfort should be well looked after. At the quarantine station at the mouth of the Mississippi there are (1) House of Senior Physician screened throughout, (2) House of Assistant Physician screened throughout, (3) Disinfecting house used when necessary, (4) Mess hall for labourers, (5) Superintendent's House, and separated by about 200 yards from these, two hotels for the accommodation of the quarantine passengers.

If the two blocks mentioned above be put into thorough repair as agreed upon, Belize will possess good quarantine hotel accommodation.

4.—PROVISION FOR THE ISOLATION AND CARE OF QUARANTINABLE DISEASES.

(See Articles XXXV. and XXXVI. of the Washington Convention, 1905.)

An isolation hospital is urgently needed in the Colony for the reception of real or suspicious cases of quarantinable diseases occurring on ships. Accommodation for 12 patients with store room, nurses' room, bath room, waterclosets, kitchen, and all rooms well screened is all that is required. Such accommodation might perhaps be found by utilising a hulk and anchoring it at a suitable place; or a small hospital might be erected on the shore at some suitable place distant one mile north of the present quarantine station.

The essential feature to be aimed at is to take off patients by water from the ships or from the quarantine station (if a case developed there) to

the hospital without going through the town; and it would be better if all communication with the hospital were made by way of the water so that it would not be necessary to have an approach on the land side.

It is also of importance to reserve the hospital for the purposes of quarantine only and not to use such a hospital for cases of infectious diseases arising amongst the inhabitants.

Provided the hospital is well isolated and employed only in case of quarantine, should a case be taken to it from a ship, the Colony will naturally not be declared infected.¹

It may be urged that it may be used very rarely, and that it will have to be looked after. That is so, but the initial cost is small, the annual sum of money necessary to watch and maintain it in order would be small, and in return the security to the Colony would be very great.

A quarantine station should not be allowed to be erected without isolation hospital accommodation, for passengers in quarantine require as much protection as the inhabitants of the town. A suspicious case of fever occurring amongst the passengers in quarantine station should at once be removed by sea to the isolation hospital under bars.

During the epidemic at Belize this summer Yellow fever developed in a passenger in quarantine station shortly after he left the ship, the patient having obviously been infected at Puerto Cortes, the port from which he had sailed. He was not removed, but placed under bars in the quarantine station which was otherwise unprotected and kept there till he recovered. I do not understand that the station was fumigated after his removal or when it was recognised that he had Yellow fever. Under such circumstances I am of opinion that a foreign nation might argue that quarantine had not properly been carried out in accordance with Article IX. of the Convention, and might have declared the port infected, although there might not have been any Yellow fever amongst the inhabitants of Belize.

No risks can be taken with Yellow fever, and in this case there was a possible risk from infected mosquitoes infecting for a considerable time both attendants and passengers undergoing quarantine.

5.—ALTERATIONS IN THE QUARANTINE REGULATIONS TO BRING THEM UP TO DATE.

The Quarantine Ordinance of British Honduras is dated 1894, and was founded, I am informed by the Colonial Surgeon, upon a draft recommended by the Quarantine Conference of 1888.

Our knowledge of the methods of transmission of two of the most important quarantinable diseases, namely Yellow fever and plague, has undergone since that time a remarkable change. The change is altogether on the side of directing action specially against the agents which transmit the disease. So that action has been concentrated and made precise, and the loss of time and of materials and often the waste of life has been very greatly diminished.

¹ See West Indian Inter-Colonial Sanitary Convention, 1904, and Pan-American International Sanitary Congress, 1905.

Inspection of the Articles of the second general International Pan-American Sanitary Convention, October, 1905, as well as of the West Indian Convention, 1904, shows at a glance when compared with the older quarantine regulations the advances which have been made.

In the first place it becomes obvious that the power to carry out quarantine effectively and the general sanitary soundness of a country will always be salient factors in the eyes of most advanced nations. In the second place, quarantine is becoming not a means of exacting revenue or a reason for exhibiting inhumanity, but an international maritime sanitary measure for the suppression of certain infective diseases.

With regard to British Honduras I would therefore recommend combining with the United States and the other American Republics, and with the West Indies in making common cause against the quarantinable diseases, and to adopt as the basis of our quarantine the Articles of the last International Pan-American Convention.

It is unnecessary here to recapitulate them, as I have already summarised them in the succeeding chapter, and judging from a very close observation of the working of quarantine upon fruit and other vessels during the Yellow fever epidemic of this year in the Gulf and in Central American Ports, they will in my judgment combine the maximum amount of efficiency with the minimum disturbance to trade and discomfort to passengers.

It must be always recollected that as the country which quarantines has considerable discretionary powers, much will depend upon the sanitary conditions of the port of departure of the vessel.

I am further of opinion that under Clause XXXIV. a mutual arrangement can be made whereby passengers can travel during periods of infection. This year passenger traffic was paralysed in Belize, and great loss of time, money, hardship and suffering caused thereby.

CHAPTER XI.

FEDERAL AND STATE QUARANTINE OF THE UNITED STATES, INTERNATIONAL SANITATION OF THE PAN-AMERICAN REPUBLICS, 1905, AND THE WEST INDIAN INTER-COLONIAL SANITARY CONVENTION, 1904.

FEDERAL AND STATE QUARANTINE OF THE UNITED STATES AND INTERNATIONAL SANITATION OF THE PAN-AMERICAN REPUBLICS.

IN this chapter I refer both to the measures which the United States Government adopts to prevent Yellow fever entering the States, and to the movement which it has set on foot throughout the American Republics to get rid of Yellow fever by combined action. The United States, stimulated without doubt by the success of its work in Havana, has more than any other country in recent years directed particular attention to Yellow fever, and since the recent severe epidemic in New Orleans, with new facts at its disposal, its action will, there is reason to believe, be still more vigorous. The International Sanitary Convention of the Pan-American Republics held in Washington in October is evidence of this. The Southern and Central American Republics, including those which surround British Honduras, have combined with the United States in an endeavour to eliminate Yellow fever from those places in which that fever is endemic or liable to occur owing to their *Geographical Position, Commercial Relations or Bad Sanitary Conditions*.

British Honduras from its geographical position, commercial relations, and from the fact that the *Stegomyia fasciata* exists in abundance at its ports, is a place exposed to Yellow fever; the large number of British ships which trade in the Gulf and with Central and Southern America are liable to convey Yellow fever, and, lastly, the increased interoceanic communications across Central America and the projected Panama Canal, all of which bring infectious disease nearer to the East, are reasons which make modern international sanitary movements of the greatest importance to Great Britain.

Previous to the year 1893 each State of the Union had its own quarantine laws, and often used them to the detriment of neighbouring rival States. For instance, a State might either be very lax in enforcing quarantine and so threaten the safety of the Federal States as a whole, or quarantine might be made a pretext for exacting exorbitant charges, and might then constitute an unnecessary drag on commerce.

In 1893 an Act of Congress was framed, followed subsequently by certain addenda, empowering the Secretary of the Treasury to promulgate *uniform quarantine regulations* for the ports of the United States, to be put into force by the separate States or by the Municipalities. The Act, however,

conferred power upon the United States Marine Hospital Service to carry out the quarantine laws, and to ensure by means of frequent inspection that the separate States and Municipalities carried them out properly. At a certain number of ports the carrying out of quarantine was handed over by the State to the central machinery of the Federal Government, that is, the United States Marine Hospital Service, whilst in certain instances the national Government assumed charge because of non-compliance of the local authority with the Law. But a number of States still conduct their own quarantine, and whilst the Federal Government takes care that the quarantine law is administered, it has no right to prevent a State or Local Authority adding additional and often onerous quarantine measures to the minimum standard which they regard as efficient. This has been made very prominent this year during the epidemic of Yellow fever in New Orleans, and the opinion has been freely expressed that, in the interests of safety and commerce, there should be an exclusive national control. The present dual system is complex, and, moreover, as the Local Authority may exact fees, whilst the Federal Government does not, commerce would gain by the change.

The object of the laws are to protect the entry of infectious disease into the United States, not only by quarantine regulations at the port of arrival of ships into the States, but also by the exercise of vigilance and precautionary measures at the port of departure in the infected foreign country and during the voyage of the vessel.

To attain this object the United States Marine Hospital Service has promulgated a series of regulations and undertaken work which has already done much to protect the United States from the entrance of infection. It helps to instruct local Sanitary Authorities in Central American and other States, and it undertakes investigations to throw light upon quarantinable diseases in order that accurate and simple regulations may from time to time be issued to ensure maximum safety with as little inconvenience to trade as possible. Recognising that with increasing knowledge regulations which are enforced to-day may at any time require alteration to come into line with the progress made in medical science.

The machinery whereby the United States Marine Hospital Service attains the main object of the quarantine laws, namely, to keep out disease requires careful consideration, because British Honduras shares with the United States the danger of trading with countries in which Yellow fever is endemic or of frequent occurrence, and in which, recently, cases of plague have occurred.

Method of Inspection.—In the first place Bills of Health must be procured from the United States Consul or Vice-Consul or from a United States Marine Hospital Service Officer especially appointed by the President. In practice the most satisfactory method is found to be the appointment of medical officers to the various Consulates in suspected ports. The duty of these medical officers is to become acquainted with the health conditions of the port and to be on the look-out for any suspicious cases, and to visit other places along the coast or in the interior if suspicion attaches to them. Not only do these medical officers succeed in obtaining this information, but their opinion on sanitary matters is often fully sought by the local Sanitary Authority; moreover,

their information is often used by our own Consuls in drawing up Bills of Health for ships destined for British ports.

The medical officer during the period of duty from May to November must make a weekly report of his transactions to the Surgeon-General at Washington. These reports are published in a bulletin issued weekly from Washington, and serve to give an accurate picture of the state of infection at the various ports and other places in tropical countries trading with the States. The reports are of great service to our own Quarantine Boards, and often constitute the only quick and concise channel through which reliable information can be obtained upon the health conditions obtaining in surrounding countries.

The following is an example affecting Belize of the promptitude with which these medical officers act. An extract from the Public Health and Marine Hospital reports dated Washington, June 9th, 1905, reads :—

BRITISH HONDURAS. REPORT FROM BELIZE, FRUIT PORT.—YELLOW FEVER.

Acting Assistant-Surgeon Carson reports as follows :—Week ending May 25th, 1905. Present official estimated population, 8,500; number of deaths seven, including two from Yellow fever; general sanitary condition of this port and surrounding country during the week, not good. Confirming my cablegram of the 22nd inst. to the Bureau via Puerto Cortes, Honduras, and reading as follows :—“Two cases of Yellow fever, one death, Belize, Carson.” I have the honour to state relative thereto, that two cases of Yellow fever occurred in this port on the 16th and 18th inst. respectively. The first died, but the second case was Captain O. B., of the British steamer “Whitehall,” lately wrecked off this coast. The captain was taken ill on the 15th inst., and was removed from an hotel to the Government Hospital on the 20th, when he died next day. I was present by invitation, with Dr. Harrison, Asst. Col. Surgeon, at the autopsy. And I am firmly of opinion that death was due to Yellow fever.” Further on Dr. Carson reports : “The second death was of the Rev. G. W. C., an Englishman, aged 37, and residing here for the past eighteen months. He was taken ill on the 16th. The attending physicians regarding the case as suspicious asked me for a consultation on the 21st, &c. . . . I am informed by a local physician that there are several other suspicious cases of fever in this port, and Dr. Eyles states that he has several cases in hospital under observation.” “I cabled Mobile and New Orleans when I cabled the Bureau on the 22nd inst., and Acting Assistant-Surgeons Peters (Livingston) and Carter (Puerto Cortes) were informed by mail (no wire exists) as to the existence of Yellow fever at this port.”

By this action the United States and the Sanitary Authorities at the principal ports in Guatemala and Honduras were warned at the very commencement of the outbreak.

The medical officer at the port of departure carries out the fumigation of the ship destined for the States just prior to her leaving, and takes the temperature of passengers and crew. Passengers desirous of leaving by the ship would have notified to the medical officer their intention of so doing seven days previously. In this way he not only obtains the names of passengers, but ascertains their movements prior to departure. They are further instructed

to take precautions about the introduction of mosquitoes on board and to prevent their breeding.

It is laid down that vessels carrying passengers from any port or place where quarantinable disease prevails in epidemic form should have one medical officer. During this year the fruit steamers, whether carrying passengers or not and trading between the States, Belize and Central American Republics, carried doctors. These doctors were appointed by the States Board of Health, and co-operated with the United States Marine Hospital Service. They inspected the crew and passengers daily, took temperatures and pulse rate.

Thirdly, on arrival, a medical officer, Federal or State as the case may be, meets the ship at some advantageously placed quarantine station. In the case of ships entering the Mississippi, the ship is first met by a medical officer of the Louisiana State Board of Health, who makes his inspection and fumigates with the view of preventing the entry into the State of infected mosquitoes. If the ship has not been out six days since leaving an infected port, during the quarantine season, she is either quarantined at the station until the six days are up, or the ship after fumigation is allowed to proceed, but the passengers are taken off and placed in quarantine. Should any doubtful case of fever be found on board, or develop in the quarantine station, it is at once removed to the isolation hospital farther down the river.

On arrival at New Orleans the ship must be met by a medical officer of the United States Public Health and Marine Hospital Service, who, as representing the Federal Sanitary Authority, examines the passengers under the *Immigration Act* for cases of insanity, ophthalmia, &c. (Div. of Medical Inspection of Immigration of M.H.S.)

To sum up, the United States Government, through its Marine Hospital Service, watches over the sanitation of ships, their crews, and passengers destined for the States in the various foreign ports, and at the same time informs the Central Government of the state of Health of the foreign ports. At the port of entry into the United States it guards against the importation of diseased persons under the *Immigration Act*, or persons suffering from quarantinable disease under the *Quarantine Act*, if the local authority does not do so. But as is the case of Louisiana, the State Board administers the quarantine regulations independently prescribed by itself, and in order to carry them out appoints medical officers to ships, and erects quarantine stations and takes such other precautions as are necessary to conform to the law, and protect, in the best way in their judgment, the State of Louisiana.

INTERNATIONAL SANITATION—PAN-AMERICAN REPUBLICS.

In October, 1901, a meeting was held in the City of Mexico to discuss the establishment of an International Health Service, and Surgeon-General Wyman was asked to frame the subjects for discussion.

In the first place, it was thought more practical to confine the attention of the Convention to Yellow fever alone, a disease which directly affected the interests of 25,000,000 in the Pan-American Republics. In the second place, that the object of the international agreement should be confined to the elimination of Yellow fever from seaports alone.

It was urged in favour of holding the Convention that owing to the recently made discoveries of the mode of transmission of Yellow fever, the time had come for common action amongst the American Republics.

Object of the Commission.—The elimination of Yellow fever from seaports which are or have been endemic habitats of Yellow fever, or which are liable to become foci by reason of geographical situation, commercial relations and bad sanitary conditions.

The measures proposed for discussion were—

- Sanitary improvement of Harbours.
- Sewage.
- Soil drainage.
- Paving.
- Elimination of infection from buildings.

An International Sanitary Bureau was established with Surgeon-General Wyman as Chairman, and annual meetings have been held to discuss quarantine and sanitary laws from the most recent standpoints, with special reference to the mosquito, in relation to Yellow fever and Malaria.

Early in October, 1905, a second General International Sanitary Convention of the American Republics was formally summoned by the International Health Bureau, and was held in Washington. The Presidents of the Republics of Chile, Costa Rica, Cuba, Dominican Republic, Ecuador, Guatemala, Mexico, Nicaragua, Peru, United States of America and Venezuela agreed to adopt, *ad referendum*, after full discussion by their respective representatives at the Convention, certain regulations as soon as plague, cholera, or Yellow fever appeared in their territory. As this is the latest movement in American International Sanitation, and affects both British Honduras and other Colonial possessions in South America and in the West Indies, I give the Articles agreed to in so far as they affect the control of Yellow fever. The Articles are based upon our most recent knowledge, and may well serve as the foundation of quarantine regulations against Yellow fever in British Honduras.

Article I.—Immediate notification by the Government in whose territory an authentic case of Yellow fever has occurred to the other Governments.

Article II.—Information to be furnished to the other Governments upon the Yellow fever situation, such as place of origin, number of cases, deaths, &c. Distribution of *Stegomyia fasciata*. Prophylactic measures taken.

Article III.—The above information to be directed to the Diplomatic and Consular agent in the infected capital of the country and to officials charged with the public health of the several countries.

Article IV.—Provides for regular weekly report of progress of the fever to the various Governments, including, in detail, the precautions taken to prevent the extension of disease

1. Measures of inspection, isolation and disinfection.
2. Measures taken to prevent the exportation of disease or infected mosquitoes on departing vessels.

Article V.—Strongly recommends making it obligatory upon each Government to declare the first case.

Article VI.—Relates to the organisation of a service of direct information between the chiefs of administration upon the frontiers.

Article VII.—Information of a first case of plague, cholera or Yellow fever does not justify against a territorial area when it may appear, the application by other countries of the prescribed measures of defence.

"Upon the occurrence of several non-imported cases of plague, or a non-imported case of Yellow fever or when cases of cholera form a focus, the area is to be declared infected."

Article VIII.—Limits the restrictive measures to the affected region or area and defines what is implied by "area." But the narrowing down of restrictive measures to a particular area in a country will depend upon the measures taken by the Government of the infected country to confine the fever to the particular area, and provided also that Article I. has been faithfully complied with.

"When an area is infected no restrictive measure is taken against departures from this area if these departures have occurred five days, at least, before the beginning of the epidemic."

Article IX.—That an area should no longer be considered as infected official proof must be furnished, (1) That there has been neither a death nor a new case of Yellow fever for 18 days after isolation, death or cure of the last case, but each Government may reserve the right to extend the period. (2) That measures against mosquitoes have been executed.

Note.—"By isolation in the case of Yellow fever is understood the isolation of the patient in an apartment so screened as to prevent the access of mosquitoes.

The following articles deal with the defensive measures adopted by other countries against an infected territory :—

Article X.—The Government of each country is obliged to immediately publish the measures which it believes necessary to take against departures either from a country or from an infected territorial area.

The said Government is to communicate at once this publication to the diplomatic or consular agent of the infected country residing in its capital as well as to the International Sanitary Bureau.

The Government shall be equally obliged to make known through the same channels the revocation of these measures or modifications which may be made in them.

In default of a diplomatic or consular agency in the capital, communications are directed to the Government of the country interested.

Article XI.—States that there is no merchandise itself capable of transmitting Yellow fever, it only becomes dangerous when it harbours mosquitoes.

Article XII.—No merchandise or objects shall be subjected to disinfection on account of Yellow fever, but the vehicle of transportation may be subjected to fumigation to destroy mosquitoes.

Article XIII.—States that if merchandise is properly protected, transportation through an infected territory should not debar its entry into the country of destination.

Article XIV.—That merchandise should not be prohibited if it were shipped at least five days before the beginning of the epidemic.

Article XV.—Provides for the authority of the country of destination to fix method and plan of disinfection for destruction of mosquitoes. The disinfection to be carried out so as to cause the least possible injury to merchandise.

If taxes are levied by a sanitary authority, either directly or through the agency of any company or agent, to insure measures for the destruction of mosquitoes on board ships, the amount of these taxes ought to be fixed by a tariff published in advance, and the result of these measures should not be a source of profit for either state or sanitary authorities.

Article XVI.—In case of Yellow fever postal parcels are not to be subjected to any restrictions or disinfection.

Articles XVII. and XVIII.—Relate to merchandise requiring disinfection more especially in the case of plague.

Article XIX.—Baggage.—There shall be no disinfection of baggage on account of Yellow fever.

Article XX.—Classification of Ships.—A ship is considered as infected which has plague, cholera or Yellow fever on board, or which has presented one or more cases of plague or cholera within seven days, or a case of Yellow fever at any time during the voyage.

A ship is considered as suspected on board of which there have been a case or cases of plague or cholera at the time of departure or during the voyage, but no new case within seven days; also such ships as have lain in such proximity to the infected shore as to render them liable to the access of mosquitoes.

The ship is considered indemne, which, although coming from an infected port, has had neither death nor case of plague, cholera or Yellow fever on board, either before departure, during the voyage, or at the time of arrival, and which in the case of Yellow fever has not lain in such proximity to the shore as to render it liable, in the opinion of the sanitary authorities, to the access of mosquitoes.

Articles XXI. to XXXI. deal with cholera and plague.

Article XXXII.—Ships coming from a contaminated port, which have been disinfected, and which may have been subjected to sanitary measures applied in an efficient manner, shall not undergo a second time the same measure upon their arrival at a new port, provided that no new case shall have appeared since the disinfection was practised, and that the ships have not touched in the meantime at an infected port.

When a ship only disembarks passengers and their baggage, or the mails, without having been in communication with *terra firma*, it is not to be considered as having touched at a port, provided that in the case of Yellow fever it has not approached sufficiently near the shore to permit the access of mosquitoes.

Article XXXIII.—Passengers arriving on an infected ship have the right to demand of the sanitary authority of the port a certificate showing the date of their arrival, and the measures to which they and their baggage have been subjected.

Article XXXIV.—Packet boats shall be subjected to special regulations, to be established by mutual agreement between the countries interested.

Article XXXV.—Without prejudice to the right which Governments possess to agree upon, the organisation of common sanitary stations, each country should provide at least one port upon each of its seaboards, with an organisation and equipment sufficient to receive a vessel, whatever may be its sanitary condition.

When an indemne vessel, coming from an infected port, arrives in a large mercantile port, it is recommended that she be not sent to another port for the execution of the prescribed sanitary measures.

In every country ports liable to the arrival of vessels from ports infected with plague, cholera or Yellow fever, should be equipped in such a

manner that indemne vessels may there undergo immediately upon their arrival the prescribed measures, and not be sent for this purpose to another port.

Governments should make declaration of the ports which are open in their territories to arrivals from ports infected with plague, cholera or Yellow fever.

Article XXXVI.—It is recommended that in large seaports there be established :—

(a) A regular medical service and a permanent medical supervision of the sanitary conditions of crews, and the inhabitants of the port.

(b) Places set apart for the isolation of the sick and the observation of suspected persons. In the *Stegomyia* belt there must be a building or part of a building screened against mosquitoes, and a launch and ambulance similarly screened.

(c) The necessary installation for efficient disinfection and bacteriological laboratories.

(d) A supply of potable water above suspicion, for the use of the port, and the installation of a system of sewerage and drainage, adequate for the removal of refuse.

Articles XXXVII to XLV.—Deal with rational measures to prevent spread of infection across frontiers and by river routes. In connection with the latter and not without interest to British Honduras, Article XLV. lays down that "The power rests with Governments of countries bordering upon rivers to regulate by special arrangement the sanitary regime of river routes."

Article XLVI.—Ships infected with Yellow fever are to be subjected to the following regulations :—

1. Medical visit (inspection).
2. The sick are to be immediately disembarked, protected by netting against the access of mosquitoes, and transferred to the place of isolation in an ambulance or a litter similarly screened.
3. Other persons should also be disembarked if possible, and subjected to an observation of six days, dating from the day of arrival.
4. In the place set apart for observation there shall be screened apartments or cages where anyone presenting an elevation of temperature above 37.6 degrees Centigrade shall be screened until he may be carried in the manner indicated above to the place of isolation.
5. The ship shall be moored at least two hundred metres from the inhabited shore.
6. The ship shall be fumigated for the destruction of mosquitoes before the discharge of cargo, if possible. If a fumigation be not possible before the discharge of the cargo, the Health Authorities shall order either :—

(a) The employment of immune persons for discharging the cargo ; or

(b) If non-immunes be employed they shall be kept under observation during the discharge of cargo and for six days, to date from the last day of exposure on board.

Article XLVII.—Ships suspected of Yellow fever are to be subjected to the measures which are indicated in Nos. 1, 3 and 5 of the preceding

article ; and, if not fumigated, the cargo shall be discharged as directed under sub-paragraph (a) or (b) of the same article.

Article XLVIII.—Ships indemne from Yellow fever, coming from an infected port, after the medical visit (inspection) shall be admitted to free pratique, provided the duration of the trip has exceeded six days.

If the trip be shorter, the ship shall be considered as suspected until the completion of a period of six days, dating from the day of departure.

If a case of Yellow fever develop during the period of observation the ship shall be considered as infected.

Article XLIX.—All persons who can prove their immunity to Yellow fever, to the satisfaction of the Health Authorities, shall be permitted to land at once.

Article L.—It is agreed that in the event of a difference of interpretation of the English and Spanish texts the interpretation of the English text shall prevail.

THE WEST INDIAN INTER-COLONIAL SANITARY CONVENTION, 1904.

(Presented to both Houses of Parliament by Command of His Majesty, November, 1905.)

The findings of this Convention, which have been adopted by legislation in Barbadoes, Jamaica, Trinidad, British Guiana, St. Vincent and the Leeward Islands, although only presented to Parliament, November, 1905, are based largely upon the American International Convention of 1903, certain Reports of the Public Health and Marine Hospital Service of the United States and upon a Report of Dr. Guiteras. They are, therefore, not as recent as the findings of the Pan-American International Convention of October, 1905, which are framed upon more recent observations (epidemic of 1905). The conclusions arrived at by both Conventions are broadly similar ; both endeavour to scientifically prevent the spread of Yellow fever and to produce the minimum of dislocation of traffic. On the whole, however, the provisions of the American International Convention are more rigid, and more precise, and I have drawn up a comparison of those Articles in both Conventions where differences occur, in order that the advantages or disadvantages, one way or the other, may be gauged. I am convinced that a great factor in all these quarantine regulations in the eyes of the United States will be the power and the equipment which a foreign country possesses to enforce early notification and sanitary regulations.

1. That a Central Quarantine Authority be constituted for the West Indian Colonies.

2. That in the opinion of this Conference, the provision by each of the Colonies adhering or acceding to the Convention, of an Observation Station and an Isolation Hospital, adequate in size and equipment to the volume of the passenger traffic in each colony, is indispensable to the successful working of a proper precautionary system against the introduction of infectious or contagious diseases.

3. That no fees should be charged passengers for medical supervision.

4. "That in the opinion of this Conference, so as to facilitate the efficient working of these regulations, it is desirable that a law to make compulsory the notification of infectious or contagious disease as defined in these Colonies be adopted in those Colonies where such a law does not obtain."

The following are extracts of the Quarantine Regulations adopted by the Convention, and which bear upon Yellow fever :—

Infected Place.—Means any place where any infectious or contagious disease exists ; provided that the place shall not be regarded as an infected place because of the existence thereof of imported cases of such disease, or because of the occurrence of a single non-imported case.

Infected Ship.—Means a ship on board of which a case or cases of infectious or contagious disease are present, or have occurred within a period of seven days previous to the date of the arrival of the ship, except in the case of small pox, when the period shall be twelve days.

Suspected Ship.—Means a ship on board of which a case or cases of infectious or contagious disease have occurred during the voyage, or during the stay of such ship in the port of departure, but on board of which no fresh case has occurred within a period of seven days previous to the arrival of the ship, except in the case of small pox, when such period shall be twelve days.

Healthy Ship.—Means a ship which, although having come from an infected place, has had on board no deaths from, nor any case of, infectious or contagious disease, either before leaving the port of departure or during the voyage, or on arrival.

Observation.—Means isolation of passengers, either in a proper station provided for that purpose, or on board ship, prior to their obtaining free pratique.

Surveillance.—Means that passengers are not isolated. They receive free pratique at once, and are allowed to proceed to their place of destination (the proper authority of which must be informed of their arrival), there to undergo medical supervision.

By Article III.—A place has ceased to be regarded as infected if the Health Officer is satisfied :—

(a.) That there has been no new case of Yellow fever within six days.

(b.) That measures have been taken with a view to the destruction in the infected locality of mosquitoes on and near the infected premises.

By Article V.—Infected ships shall be dealt with as follows :—

(a.) The sick shall, as soon as possible, be removed from the ship and isolated.

(b.) The other persons on board shall be permitted to land, and be kept under observation, or subjected to surveillance.

(c.) When observation is resorted to, the period shall not exceed six days in the case of Yellow fever.

(d.) When surveillance is resorted to, the period shall be the same.

(e.) In applying these measures the date of the last case and the condition of the ship to be taken into account.

(f.) In the case of Yellow fever measures shall be taken to secure the destruction of mosquitoes and their larvæ on board.

By Article VI.—Suspected ships shall be dealt with as follows :—

(a.) The passengers and crew subjected to surveillance during a period which shall not exceed six days in the case of Yellow fever. The period to date from the arrival of the ship.

(b.) That measures should be taken to secure the destruction of mosquitoes and their larvæ on board. When such measures as the Health Officer may have deemed necessary in accordance with the provisions of this article have been carried out, such ship shall immediately thereupon be admitted to free pratique.

By Article VII.—Healthy ships shall be admitted to free pratique immediately on arrival, irrespective of the nature of their bill of health. They may, however, at the discretion of the Health Officer, be subjected to the measures specified in paragraph (f.) Article V., and the passengers and crew may be subjected to surveillance during a period of six days in the case of Yellow fever. The period of surveillance shall date from the departure of the ship from the infected place.

By Article X.—A ship shall not be regarded as having called at a place if it has merely disembarked passengers and their baggage, or mails, without having been in communication with the shore.

Ships from an infected place which have been disinfected shall not again be subjected to sanitary measures on their arrival in another port if in the opinion of the Health Officer of such ports the measures applied were effective, unless a fresh case of infectious or contagious disease has occurred on board since disinfection, or unless they have again called at an infected place.

By Article XII.—Where measures of observation or surveillance are prescribed the Health Officer may exempt from their application any person who is, in his opinion, immune to the infectious or contagious disease on account of which these measures are applied.

By Article XIII.—Where these Regulations provide that a person may be permitted to proceed to his place of destination subject to surveillance, the Health Officer, before granting such permission, must be satisfied that it is reasonably probable, that the person to whom it is granted will duly comply with the conditions of surveillance, and permission, if granted, shall be upon the following conditions :—

(a.) He must satisfy the Health Officer as to his name, intended place of destination, and his place of residence thereat.

(b.) He must agree to present himself and shall present himself for medical supervision during the prescribed period, and he may be required by the Health Officer to deposit a sum not exceeding two pounds, which may be forfeited if he fail to so present himself.

(c.) The place must, in the opinion of the Health Officer, be conveniently situated for the medical supervision.

If the Health Officer is not satisfied as herein required, or if the person fails to comply with paragraphs (a) and (b) hereof, the Health Officer may detain him under observation, or direct him to proceed to a specified place, and there remain under medical supervision during the prescribed period.

In the latter case, the provisions of paragraph (b) hereof may at the discretion of the Health Officer be applied to such person.

In the case of a healthy ship the measure authorised by the foregoing proviso must not be applied to passengers who have not embarked or gone ashore at the infected place, and it should not be applied to those passengers who embarked or went ashore at the infected place if the circumstances of their stay there afford reasonable evidence of their non-infection.

By Article XIV.--Merchandise shall be only disinfected when in the opinion of the Health Officer it is infected, provided that in the case of Yellow fever merchandise shall under no circumstances be liable to disinfection or prohibition.

By Article XVI.--Nothing in these regulations shall render liable to detention, disinfection, or destruction, any article forming part of any mail, other than a parcel mail, conveyed under the authority of the Postal Administration of any Government, or shall prejudicially affect the delivery in due course, of any such mail, other than a parcel mail to the Post Office.

By Article XVII.--When any port within the Colonies is an infected place, measures shall be taken to prevent the embarkation from such port of any person showing any symptoms of infectious or contagious disease. To this end every person taking passage on a ship leaving such port shall be examined by the Health Officer immediately before the departure of the vessel. Such examination shall, as far as practicable, be made by day and on shore. Measures shall be taken to prevent mosquitoes, in the case of Yellow fever, from gaining access to ships. When access of mosquitoes to the ship cannot be prevented, measures should be taken immediately before the departure of the vessel to secure the destruction of the mosquitoes on board. The Health Officer shall give to the master of the ship a certificate stating in detail the measures taken.

By Article XVIII.--When in the case of a healthy ship from a port which is an infected place the Health Officer at the port of arrival is satisfied that the measures certified in Article XVII. have been efficiently carried out, such ship shall be exempted from the measures specified in Article VII. Provided always that if the period specified in that Article, and dating from the departure from the infected place, shall not have been complete, the passengers and crew shall be subjected to surveillance of such duration as is necessary to complete the period.

COMPARISONS BETWEEN ARTICLES OF THE WEST INDIAN AND THE PAN-AMERICAN, 1905, SANITARY CONGRESSES.

Both Conventions agree that

- (1) A Central Quarantine Authority,
- (2) Observation Stations (Quarantine Stations) and Isolation Hospitals,
- (3) Abolition of fees, and
- (4) Compulsory Notification

are essential.

Definition of—

Infected Place.--Both Conventions agree in regarding imported cases as not causing a place to be declared infected. Also that a single first non-imported case does not cause a place to be declared infected. (Article VII. Pan-American Convention).

Infected Ship.--Here there is a difference between the two Conventions. By the West Indian Conference the ship is infected if a case of Yellow fever has occurred within seven days previous to date of arrival. In the Pan-American Convention *a ship is infected if Yellow fever has occurred at any time during the voyage (from last port).*

This is no doubt necessary, as if there are mosquitoes on board the infection may be transmitted to them from the patient, and 12 days afterwards and onwards for a considerable time they may be able to transmit the disease.

Suspected Ship.—This also differs. In the case of Yellow fever the ship which is regarded as *suspected* by the West Indian Convention would be classed as *infected* by the Pan-American. By the latter authority a suspected ship is one on which, although no case of Yellow fever has occurred at any time during the voyage, nevertheless has lain in such proximity to an infected shore as to render it liable to the access of mosquitoes. (*Vide* Article XX.)

Healthy Ship.—By Article XX. of the Pan-American Convention it is only when a ship has had no case of Yellow fever during the voyage, and has not lain in such proximity to the shore as to render it liable to mosquito infection, that it is declared "*Indemne*."

Observation, Surveillance.—Both Conventions agree upon the absolute necessity of proper observation stations and isolation stations. There does not appear to be anything in the Pan-American Convention dealing with surveillance. I think that the question of surveillance should be favourably considered under certain circumstances.

"Observation," the definition of the term is similar in both Conventions.

When a place ceases to be infected.—Here there are also substantial differences. By the West Indian Convention there should not have been a new case of Yellow fever within six days. By the Pan-American not until eighteen days after *isolation*, death, or cure. Both agree that anti-mosquito measures must have been adopted.

How infected ships are to be treated.—With regard to the treatment of the sick both agree that they are to be removed at once. But the Pan-American Convention is very precise upon how the Yellow fever patients are to be isolated and removed. These very important instructions are omitted in the West Indian Conference. With regard to the other passengers, both Conventions agree that the passengers should land and be kept under observation (in quarantine) for a period of six days. The Pan-American Convention indicates how the observation station is to be protected. The West Indian Convention also allows a period of six days' surveillance.

Place where the infected ship is to be moored.—The Pan-American Convention lays down that ships must be moored at least 200 metres from the inhabited shore. In the West Indian there is no mention of this.

The fumigation of the infected ship.—Both agree that this must be done.

Suspected Ships.—As there are differences in the definition of suspected ships as regards Yellow fever, in the case of the two Conventions, strict comparison cannot be made. Were, however, the definition the same in the Pan-American Convention, the treatment would nearly coincide in the two cases, except that six days' surveillance is substituted for six days' observation by the West Indian Conference.

Healthy Ships.—Here there is a difference. By the West Indian Conference the ship is admitted to free pratique immediately, irrespective of the nature of the bill of health, and discretionary powers are given the Health Officers to fumigate and to exercise surveillance of passengers and crew. By the Pan-American Convention the trip must have exceeded six days, and the ship must have been medically inspected before departure.

Ships which have "called" at intermediate points.—Article X. of the West Indian Conference and Article XXXII. of the Pan-American agree that vessels are not regarded as having called at a place if they had not been in communication with the shore. (See Article XXXII.) and only disembarked passengers, baggage and mails.

No necessity for second fumigation.—In the same Article there is agreement about non-necessity of second fumigation, provided that no new cases shall have appeared, or that the ship shall not have touched at an infected port, and that the first fumigation was carried out efficiently.

Immunes to be exempted.—The exceptional position of the immune is recognised by both Conventions, compare Article XLIX. (Pan-American) and Article XII. (West Indian).

Treatment of Merchandise.—Both agree that merchandise be not disinfected, Article XII. Pan-American Convention, and Article XIV. West Indian Convention. But in Article XII. (Pan-American) it will be seen that the vehicle of transportation may be fumigated.

Mails.—Both agree are not to be fumigated.

Baggage.—Both agree are not to be fumigated.

Departure of Passengers from an infected area.—There are differences here between the precautionary measures to be taken according to the two Conventions. By the Pan-American Convention no restrictive measures are to be taken if the departures have occurred at least five days before the commencement of the epidemic. The West Indian Conference provides simply for an examination by the Medical Officer immediately before the departure of the vessel.

Regulations affecting Passengers travelling under surveillance.—There is nothing in the Articles of the Pan-American Conference dealing with permission being given to travellers to proceed to their destination as is the case with the West Indian Conference in Article XIII.

Prevention of access of mosquitoes to ship.—In Article XVII. of the West Indian Conference it is stated that measures are to be taken to prevent mosquitoes gaining access to the ships, and if this is not possible that measures "should be taken" to secure the destruction of the mosquitoes on board immediately before the departure of the vessel. Nothing is said as regards proximity to shore, a point laid stress upon by the Pan-American Conference.

NOTE.

SANITARY CONTROL IN MEXICO AND THE CENTRAL AMERICAN REPUBLICS.

IN Mexico, under Dr. Liceaga, sanitary administration has received a great stimulus. There is a Supreme Board of Health. Health returns are published regularly, literature is distributed to educate the public, and properly directed anti-mosquito campaigns are organised against Yellow fever and plague when it appears. The lesson that Havana has taught has not been lost in Mexico; but, on the contrary, has been put into active practice. In view of the fact that the Mexican Government is fully alive to the importance of modern prophylactic measures and that regular health statistics are published, I am of the opinion that it would be of great use if the Government of British Honduras were officially and regularly supplied with the weekly, monthly and periodical health returns and reports of a Republic which is so close to it. Such reports would be of great use to the chief sanitary officer and to the Quarantine Board.*

For reliable medical information concerning the health of the chief coast towns of the Central American Republics the only available weekly sources are the bulletins of the United States Public Health and Marine Hospital Service. This bureau has organised a very extensive and efficient medical advisory system at the chief ports in Central America, including British Honduras and in Mexico, trading with the United States. Medical officers, as previously pointed out, are stationed at the principal ports: Tampico, Vera Cruz, Progreso, Belize, Livingston, Puerto Cortes, Ceiba, Bluefields, Port Limon and Bocas del Toro, from April to November, at the season when Yellow fever would be dangerous to the southern States, if introduced. The officers inspect ships leaving for the States, and carry out fumigation when necessary. They issue health certificates to the Captain, and with the American Consuls sign the bills of health. They furnish weekly reports to the Bureau and telegraph the existence of quarantinable diseases when they are recognised. This division of the Marine Hospital Service Bureau originated in the "perennial peril, pointed out in 1896, by Surgeon-General Wyman, to which the United States was subjected because of the continued prevalence of Yellow fever in Havana, due to remedial causes." The Bureau further maintained "that all nations possessed certain international obligations in preventing the spread of epidemic disease from their seaports to the ports of foreign countries, and this idea of international co-operation in the sanitation of seaport cities has never been relinquished." As the result of this policy, the United States Government pointed out to the Spanish Government the anxiety caused to the United States by the insanitary condition of Havana; little was done, however, until the American occupation of Cuba, when Havana was freed of Yellow fever. In 1899, Surgeon-General Wyman wrote "that every nation should be held

* The "Boletin extraordinario del Consejo Superior de Salubridad," contains an account of the anti-yellow fever measures and their beneficial results during the past three years. They are printed in Spanish, French and English. They are now published monthly.

responsible for conditions within its borders or dependencies, tending to propagate epidemic diseases and to threaten other nations with which it expects to maintain a friendly commerce." With these views the International Sanitary Conventions were established, as stated in the preceding chapter, and further progress was made towards the advancement of international sanitation of seaports with the view of the eradication of Yellow fever and the lessening or abolition of quarantine restrictions.

The sanitary policy of the United States is bearing fruit. The Costa Rican Government asked for a Marine Service Officer to supervise the sanitation of Port Limon, which was at the time very bad. Active co-operation is taking place in Mexico between the Mexican and Marine Hospital Service medical officers. The Canal zone in Panama is under the strict supervision of a corps of medical officers, drawn from the War and Marine Hospital Service departments. In Livingston and Puerto Cortes the two representatives of the Marine Hospital Service, whom I met, had been freely used by the local administrations to direct prophylactic measures, and they had taken the leading part in seeking out the cases, fumigating, oiling, screening, &c. Experience, however, shows that with the cessation of the epidemic, the local Administration proceeds no further, and however active the United States medical representatives may have been they find themselves without authority to bring about permanent improvement. The question arises, therefore: Are the present Governments of certain of the Central American Republics sufficiently alive to the international obligation placed upon them of putting their trading ports in order, or have they got the necessary skilled machinery for carrying out sanitary reforms? The present state of affairs is unsatisfactory, but we may hope that, as the result of the encouraging examples of the good resulting from wise anti-Yellow fever measures, the Republics concerned will do all they can to co-operate in cleaning the seaports.

Definite action is necessary, for the fruit ports are not protected at the present time, and are liable throughout the year to Yellow fever, as the *Stegomyia fasciata* is always present.

New Orleans, which has hitherto been in a most unsatisfactory and dangerous condition, has, as the result of this year's lesson, been thoroughly screened; the United States will expect similar action on the part of other towns with which trade or commerce is to be encouraged.

With regard to the Medical Marine Service and British Honduras use is freely made of the official weekly bulletins, and our Consuls in the fruit ports of the Republics frequently consult with the Marine medical officers as to the condition of health of their port and the bill of health which they will issue to vessels bound for British ports. That this should be so is obvious in the present state of sanitary organisation in some of the Republics. It is the business of the United States medical representative to ascertain as much as possible about the health condition in the port in which he is stationed. He finds out from the local medical men the prevalence of sickness, he scrutinises the death returns, and he visits neighbouring towns on the rumour of suspicious cases.

I consider that it would be a great international gain if British Honduras were now to co-operate with the United States, with Mexico, and with the other American Republics, in the eradication of Yellow fever.

EXPLANATION OF PLATES.

PLATE I.—Examples of houses in Belize. The water receptacles are characteristic. Observe the kerosene tins in Fig. 1, and the planks, etc., for conducting the water to the barrels. Note the stepping planks and the littered condition of the yard in Fig. 2. Observe that the house in Fig. 1 is only raised about 1 ft. above the sodden ground.

PLATE II.—Other examples of water receptacles. Note that the houses are raised.

PLATE III.—Fig 5 shows how some of the public cisterns are treated. The water from the roof is conducted to the cisterns beneath the roof. Observe that they are close to the ground, which is a mistake.

PLATE IV.—The appearance indicated in plate is characteristic. Marsh is everywhere, and it is difficult to get to many of the houses.

PLATE V.—Similar condition. The houses in Fig. 10 are well raised.

PLATE VI.—In Fig. 11 there is enough water to float the canoe. In this state it is impossible to do any washing in the yard, and the water receptacles often stand in the dirty water. Fig. 12 shows a very badly placed latrine.

PLATES VII. AND VIII. show typical examples of street side drains. Owing to the general dead level of the town there is no appreciable fall in them. They should be either filled in or replaced by properly constructed canals. They now breed *Anopheles*.

PLATE IX.—Fig. 17 shows the old canal, it is very useful, does not breed *Anopheles*, takes away the night soil. A second line of canals should be constructed on similar lines. Fig. 18 shows how the end of a street may be blocked by buildings.

PLATE X.—The two figures show the position of Quarantine station in a marsh.

PLATES XI., XII. AND XIII.—These are a series of photographs kindly furnished to me by Dr. White, in charge of the Yellow Fever Campaign in New Orleans in 1905, and represent the various operations in Yellow Fever prophylaxis.

EXPERIMENTAL

1. The first experiment was conducted in a laboratory setting. The results showed that the reaction rate was significantly higher when the temperature was increased from 20°C to 30°C.

2. In the second experiment, the effect of concentration on the reaction rate was studied. It was found that doubling the concentration of the reactants led to a fourfold increase in the reaction rate.

3. The third experiment involved the use of a catalyst. The reaction rate was observed to be much faster in the presence of the catalyst compared to the uncatalyzed reaction.

4. The fourth experiment was designed to determine the order of the reaction with respect to the reactants. The results indicated that the reaction was first order with respect to the reactant A and second order with respect to reactant B.

5. The fifth experiment was a control experiment to ensure that the results were not due to any external factors. The reaction rate was found to be consistent across multiple trials.

6. The sixth experiment was a theoretical experiment where the reaction rate was calculated using the Arrhenius equation. The calculated rate was in good agreement with the experimental results.

7. The seventh experiment was a practical application of the reaction. The reaction was used to synthesize a compound, and the yield was found to be high.

8. The eighth experiment was a summary of the results. The reaction was found to be highly sensitive to temperature and concentration, and the catalyst significantly increased the reaction rate.

EXAMPLES OF WATER RECEPTACLES.

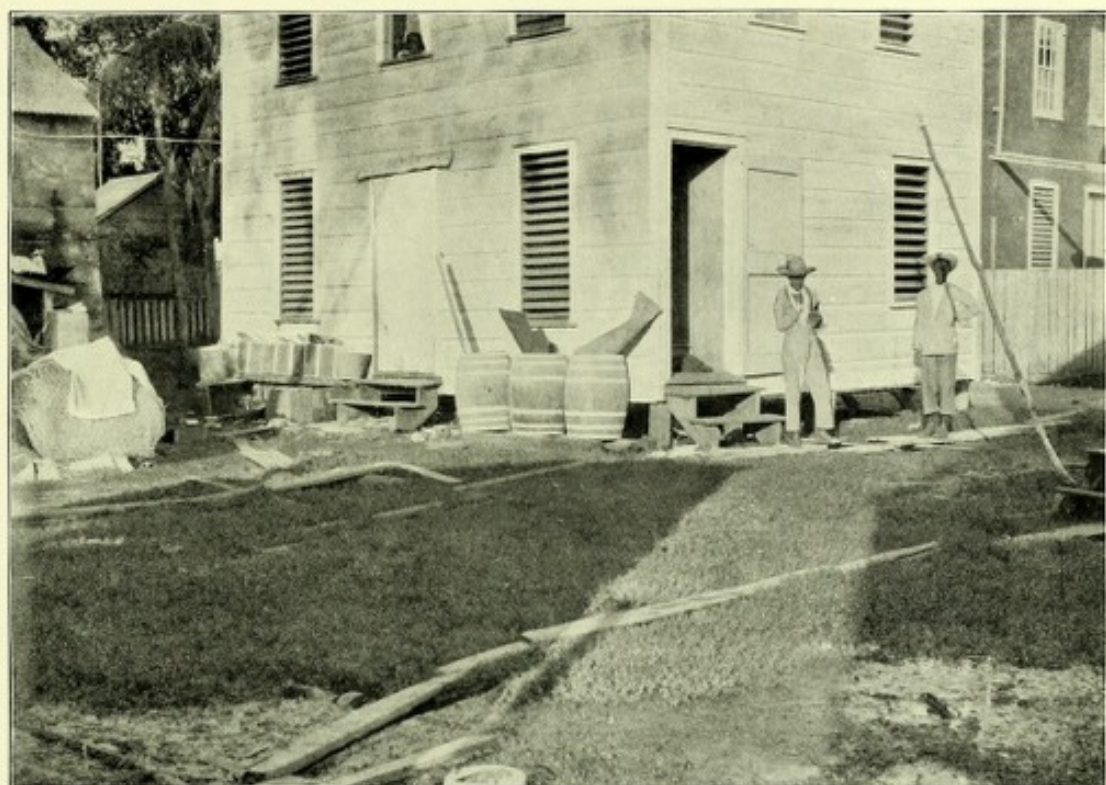


Fig. 1.

A POOR LOT. WATERLOGGED YARD.
NUMEROUS WATER RECEPTACLES CONSISTING OF BARRELS AND KEROSENE TINS.



Fig. 2.

A POOR LOT. YARD LITTERED WITH ALL KINDS OF RUBBISH.
OBSERVE THE DRINKING WATER BARRELS AND KEROSENE TINS FOR WATER STORAGE.

EXAMPLES OF WATER RECEPTACLES.

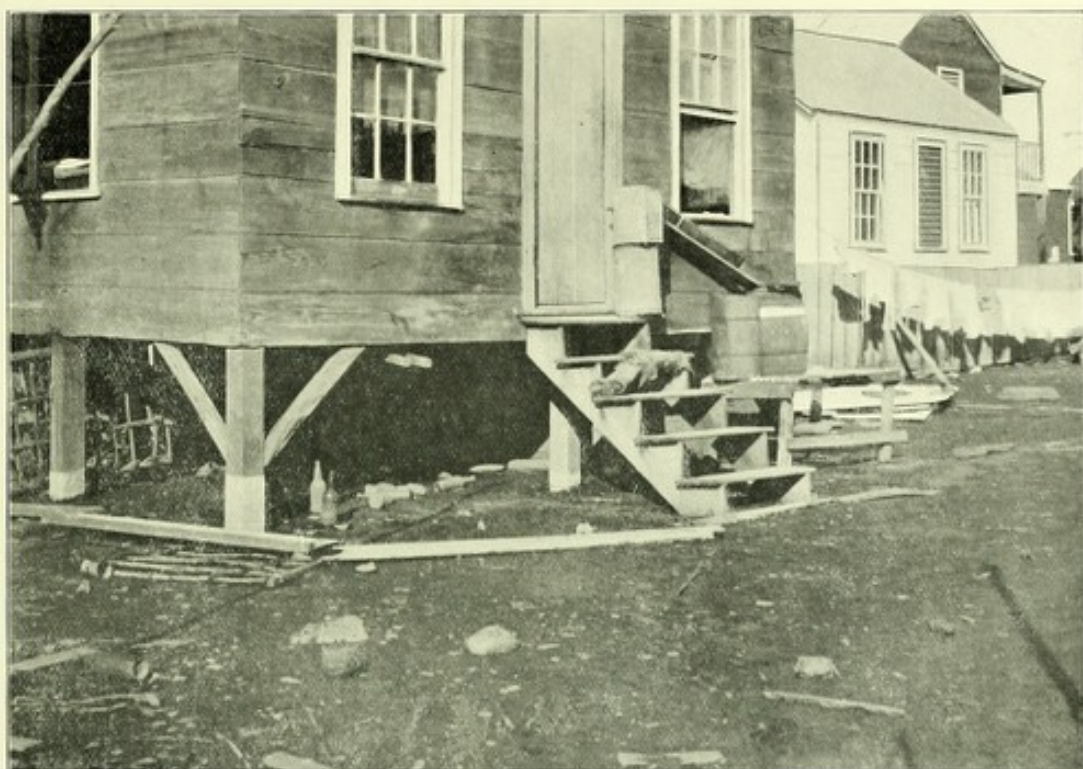


Fig. 3.

A POOR LOT. YARD DIRTY AND WATERLOGGED.

ODD RECEPTACLES, SUCH AS KEROSENE TINS AND BARRELS FOR DRINKING WATER ; THEY ARE NEXT THE LIVING ROOMS.

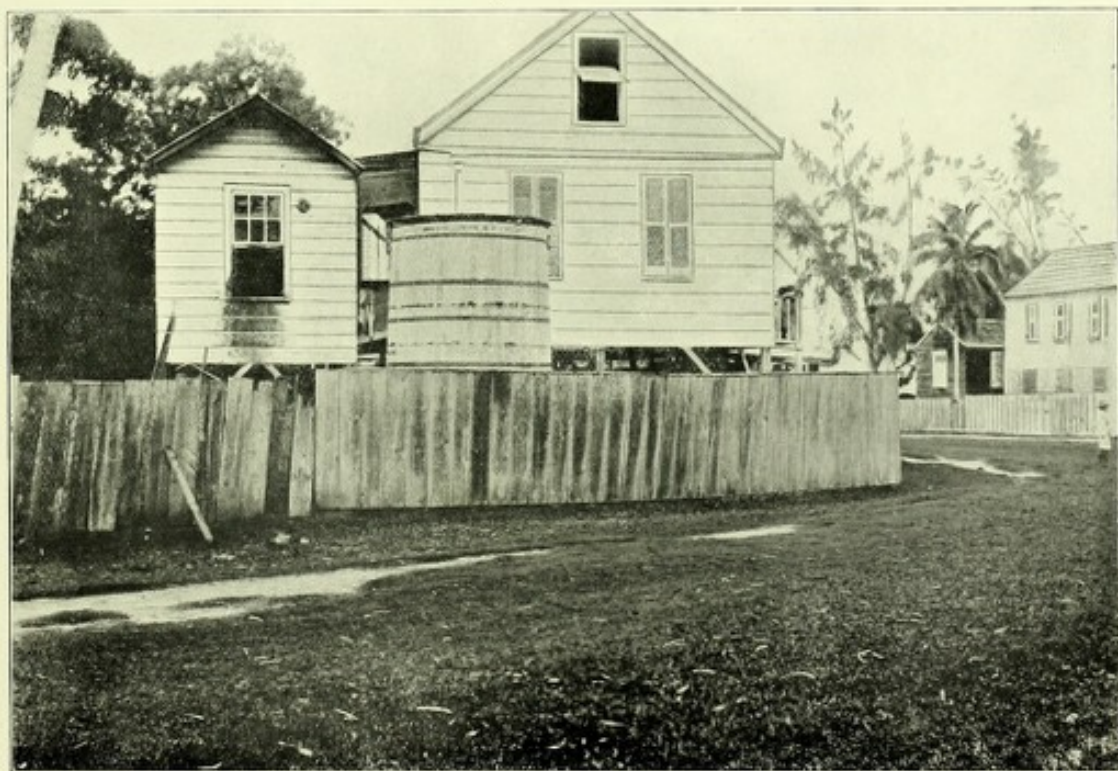
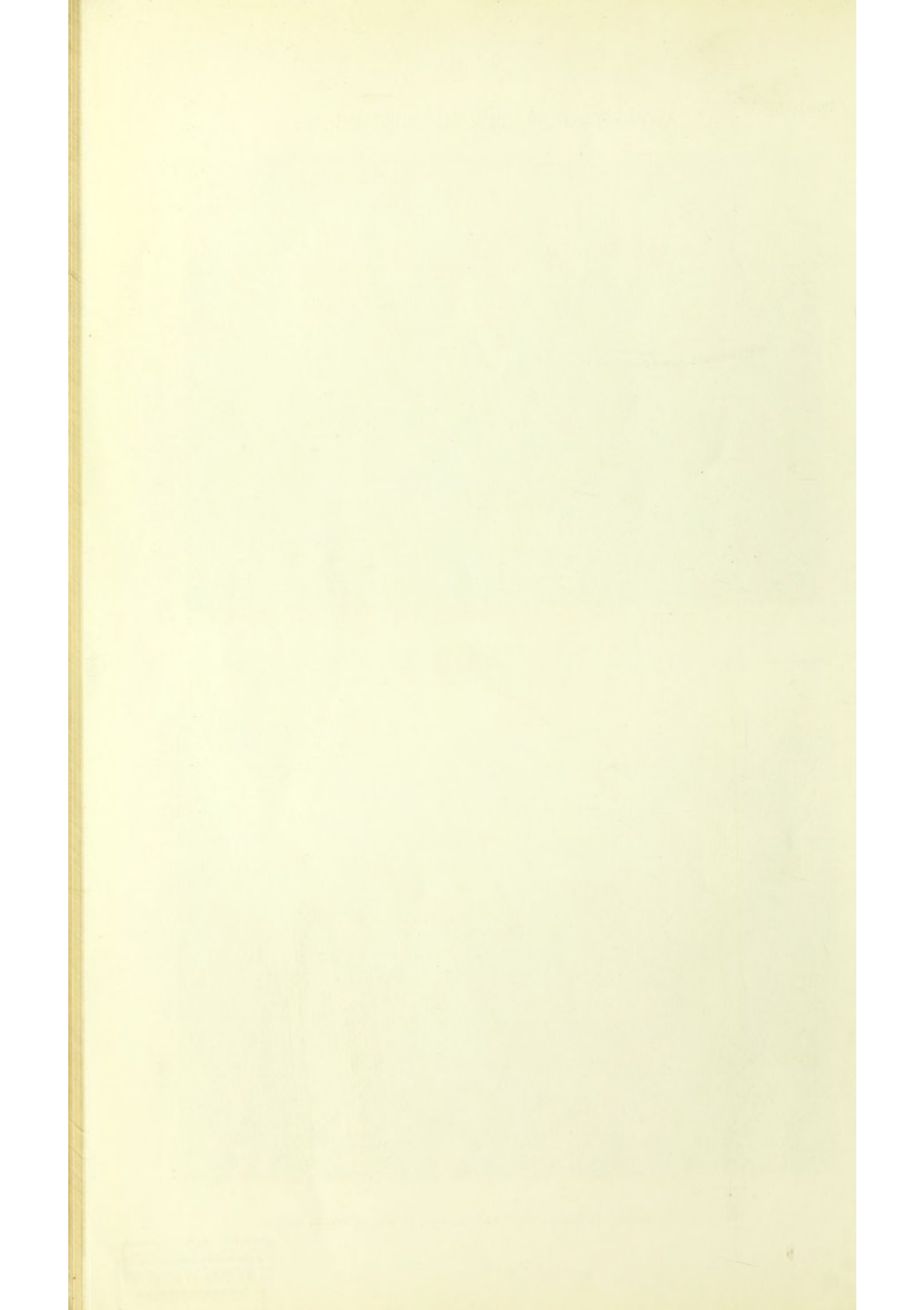


Fig. 4.

A BETTER CLASS HOUSE. LARGE CISTERN UNSCREENED, CLOSE TO LIVING ROOMS.



EXAMPLES OF WATER STORAGE CISTERNS.

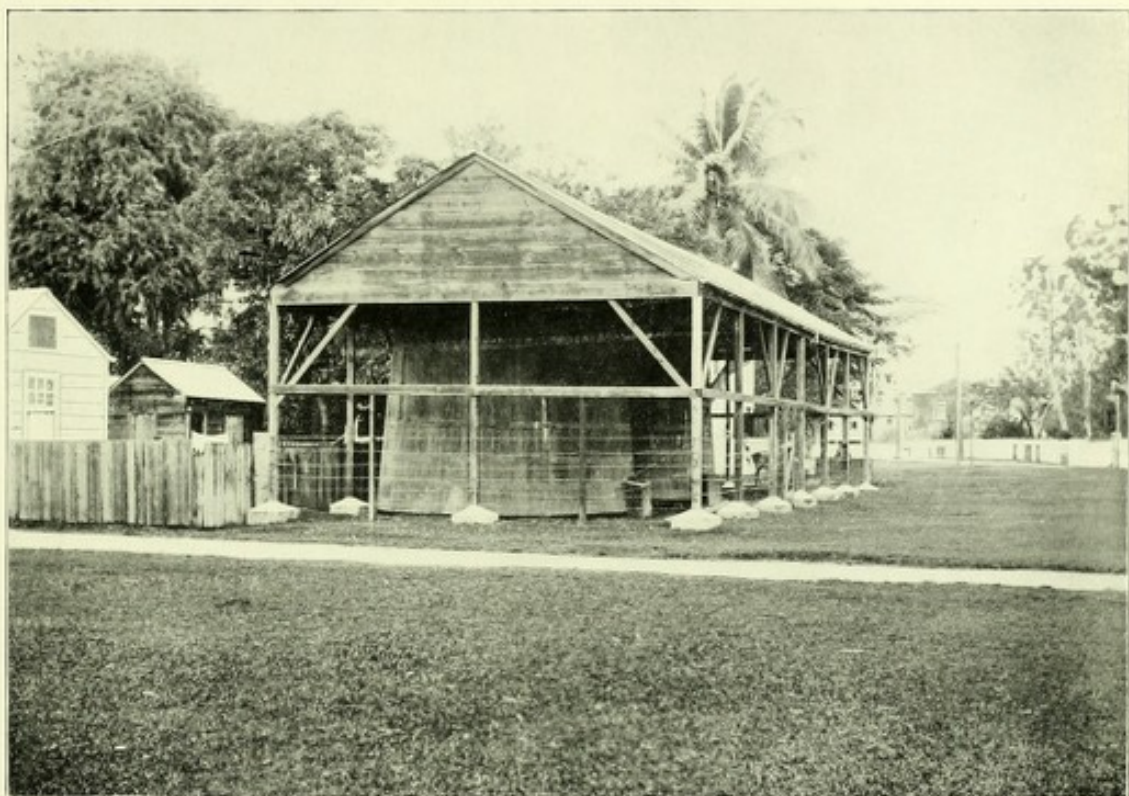


Fig. 5.
PUBLIC CISTERNS.

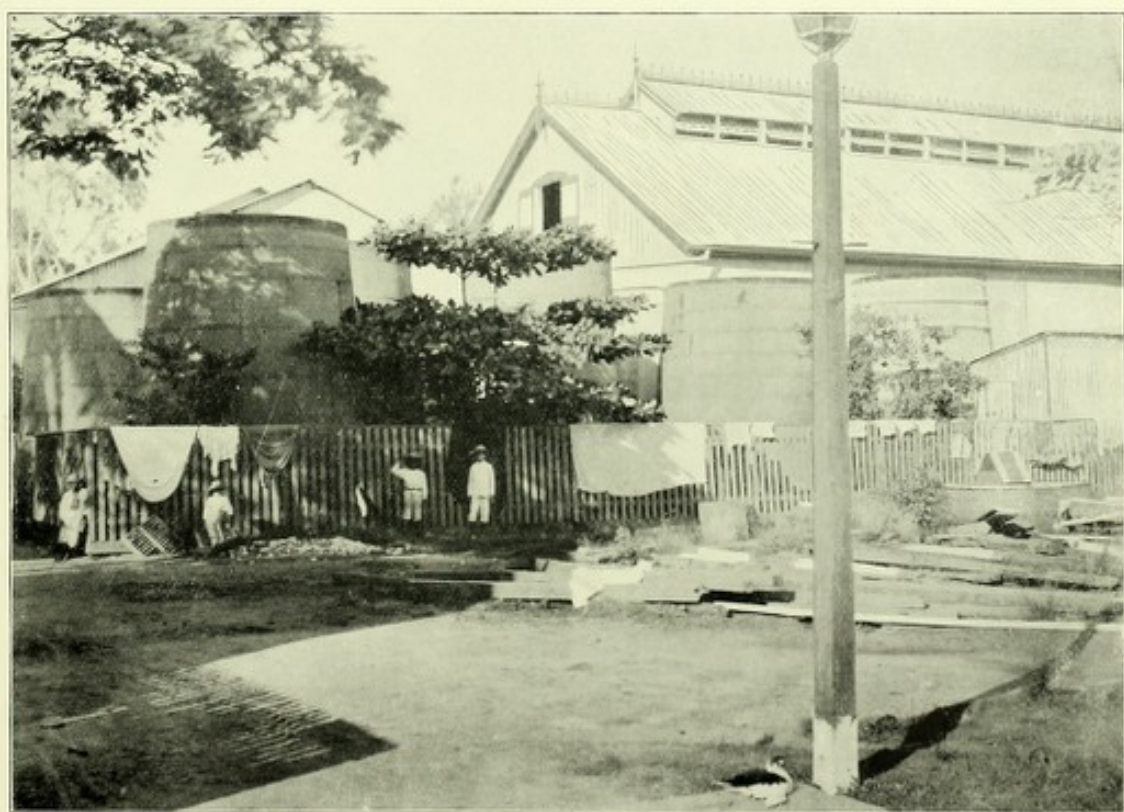


Fig. 6.
THESE CISTERNS ARE SCREENED WITH FINE WIRE GAUZE.

EXAMPLES OF "SUBMERGED" LOTS.



Fig. 7.

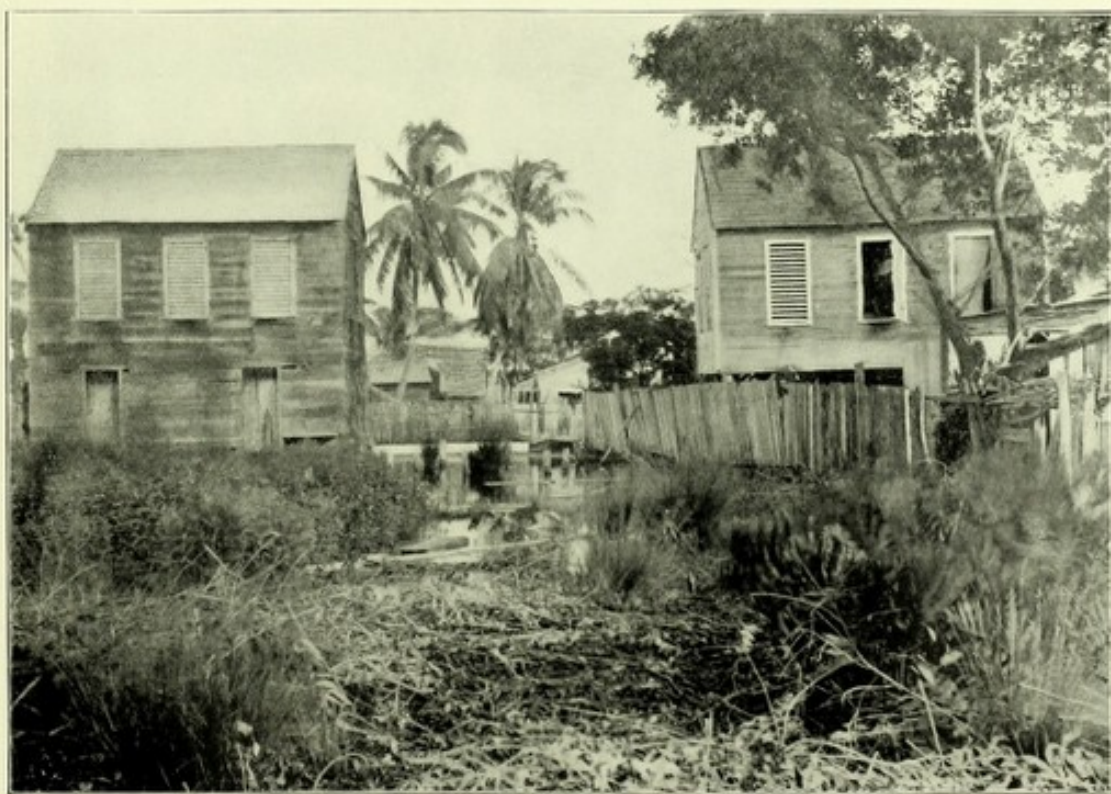


Fig. 8.

EXAMPLES OF "SUBMERGED" LOTS.



Fig. 9.

A TYPICAL NEGLECTED SUBMERGED LOT.

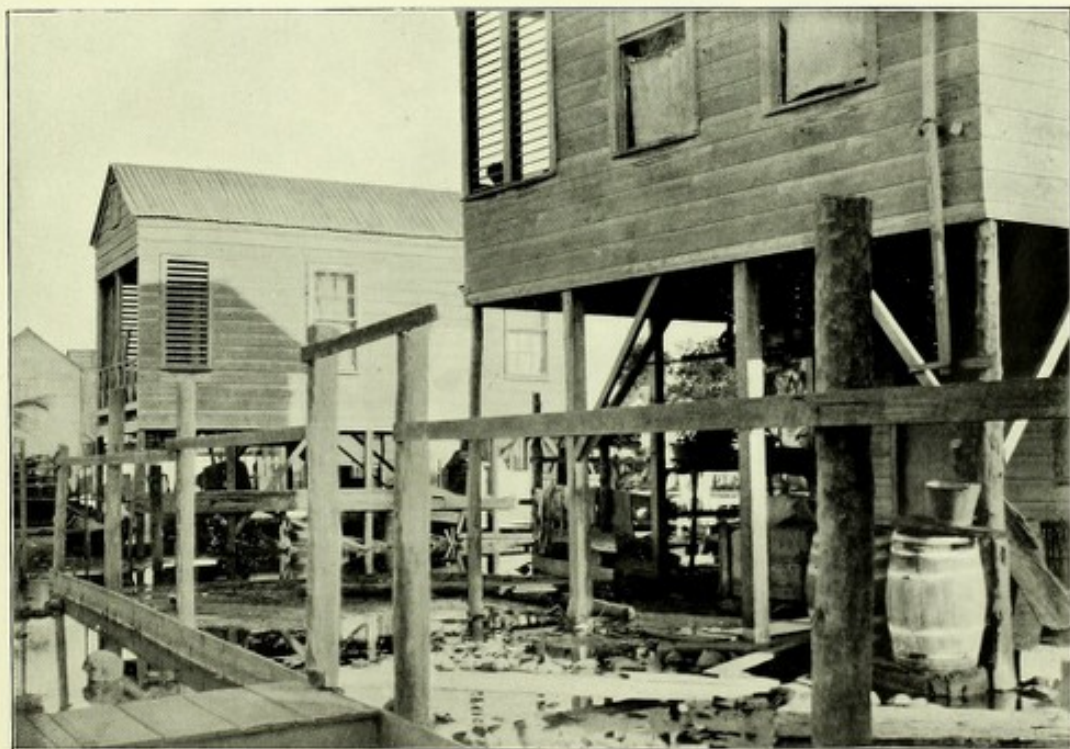


Fig. 10.

SUBMERGED LOTS.



EXAMPLES OF "SUBMERGED" LOTS.



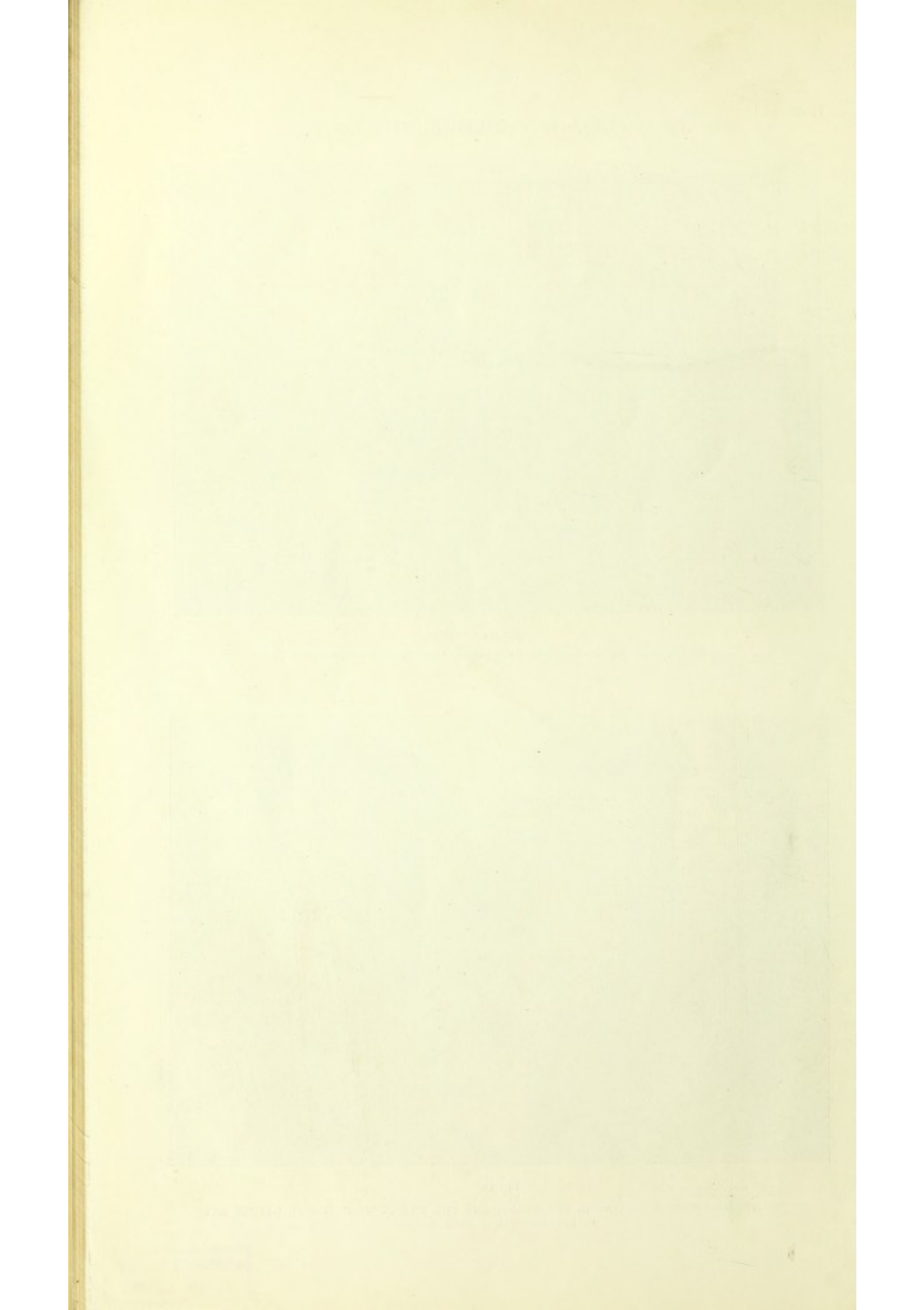
Fig. 11.

OBSERVE THE WATER BARRELS AND THE CANOE BENEATH THE HOUSE.



Fig. 12.

THIS FIGURE SHOWS A LATRINE IN THE SWAMP, AND THE WAY IN WHICH FECAL MATTER MAY BE SPREAD OVER A WIDE AREA.



EXAMPLES OF STREET DRAINS.



Fig. 13.

ANOPHELES-BREEDING STREET DRAIN. NO CIRCULATION.



Fig. 14.

ANOPHELES-BREEDING STREET DRAIN.



EXAMPLES OF STREET DRAINS.

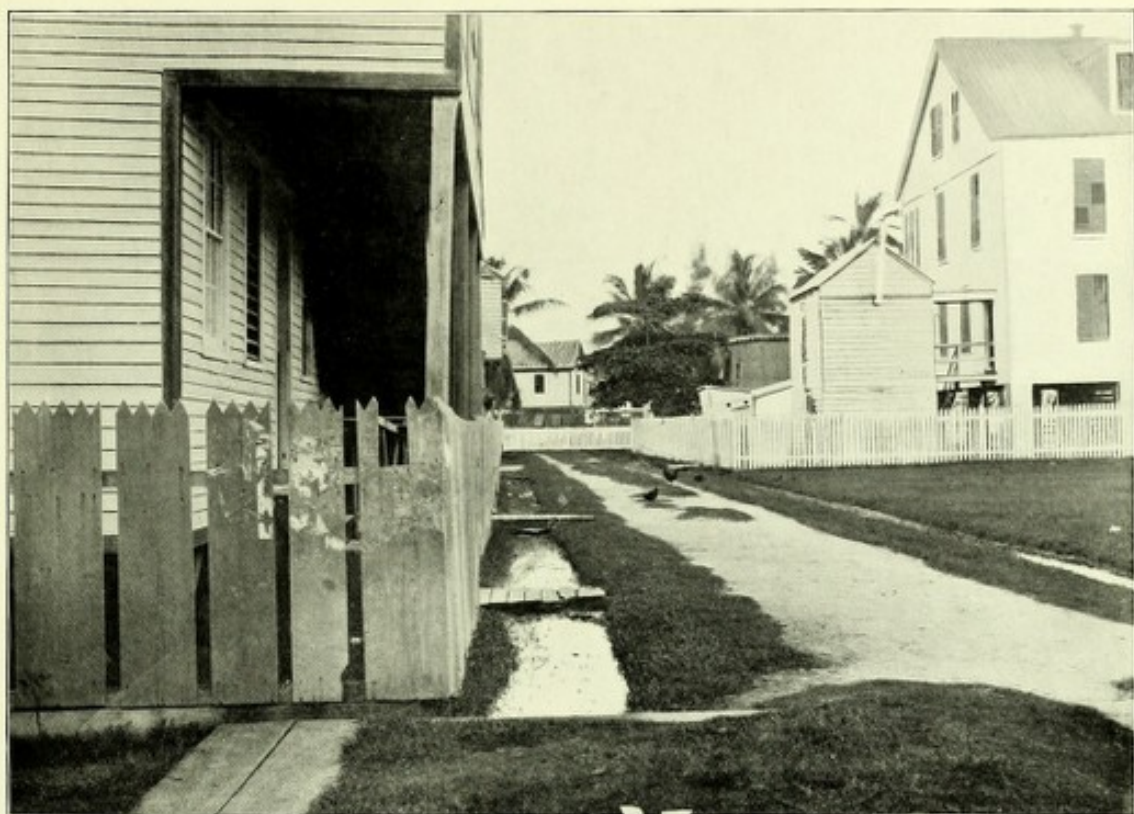


Fig. 15.

ANOPHELES DRAIN.

NO FALL, SIMPLY REPRESENTS GROUND WATER LEVEL IN WET WEATHER.

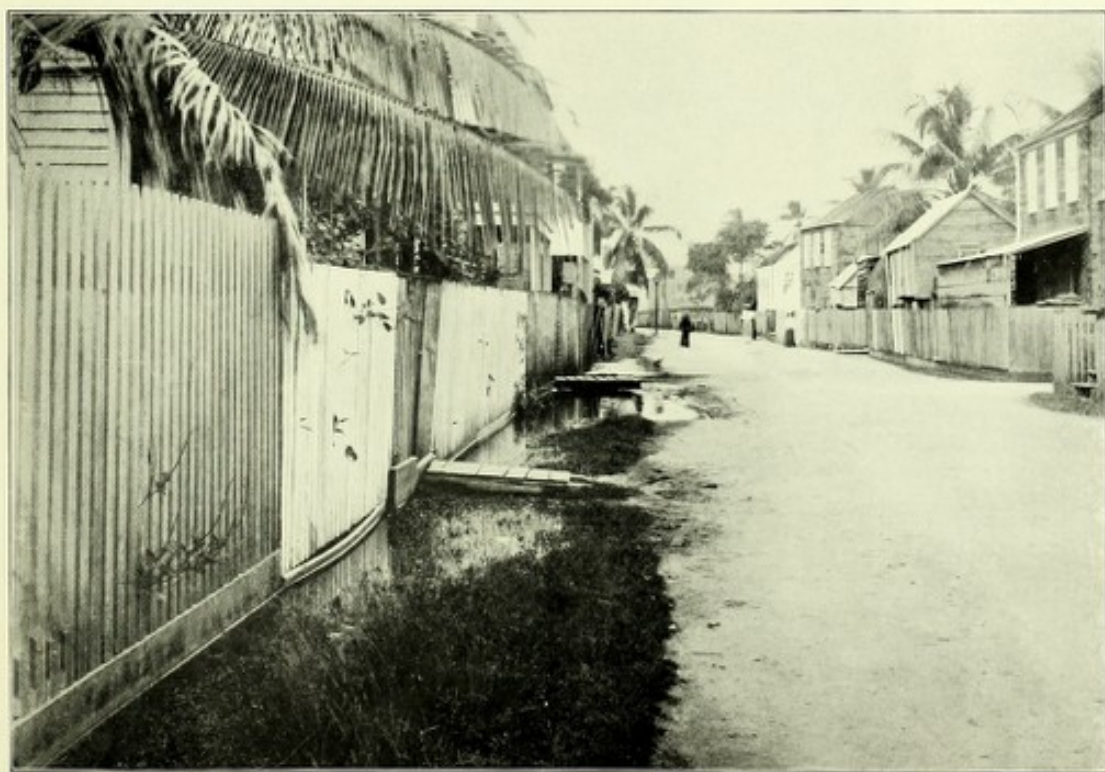


Fig. 16.

ANOPHELES DRAIN. NO FALL, AND OF NO USE FOR DRAINAGE.

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Fig. 17.

THE CANAL. NOTE THE LATRINES PLACED OVER IT.



Fig. 18.

BLOCKING OF STREETS.

THE SPACE OCCUPIED BY THE HOUSE IN FRONT SHOULD BE THE CONTINUATION OF THE STREET
OPPOSITE TO IT AND FROM WHICH THE PHOTOGRAPH WAS TAKEN.

QUARANTINE STATION, BELIZE.

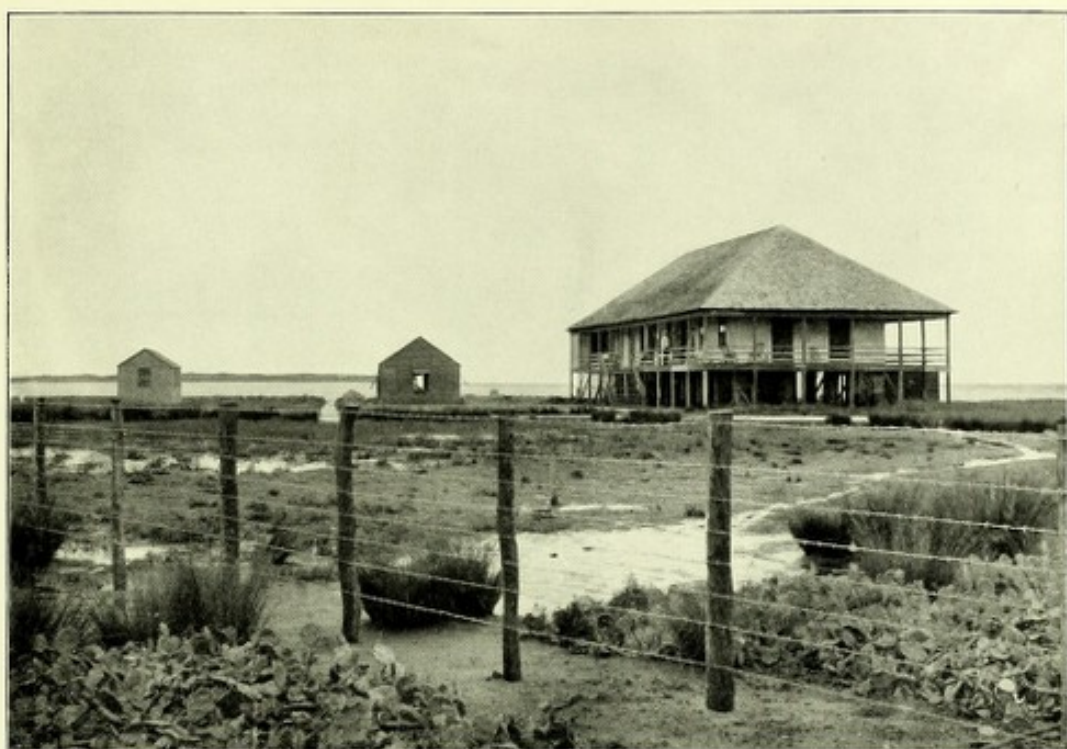


Fig. 19.

THE OLD QUARANTINE STATION. NOTE THE MARSH.



Fig. 20.

THE OLD QUARANTINE STATION AND "MARRIED MEN'S QUARTERS" TO BE USED FOR
ADDITIONAL QUARANTINE PURPOSES.

NOTE THE UNSCREENED WATER CISTERN AND MARSH. MR. BURCHELL'S ROAD IS IN THE FOREGROUND.

PROPHYLACTIC MEASURES.



Fig. 21.

A SCREENING GANG ABOUT TO START TO SCREEN A ROOM CONTAINING
A YELLOW FEVER PATIENT.

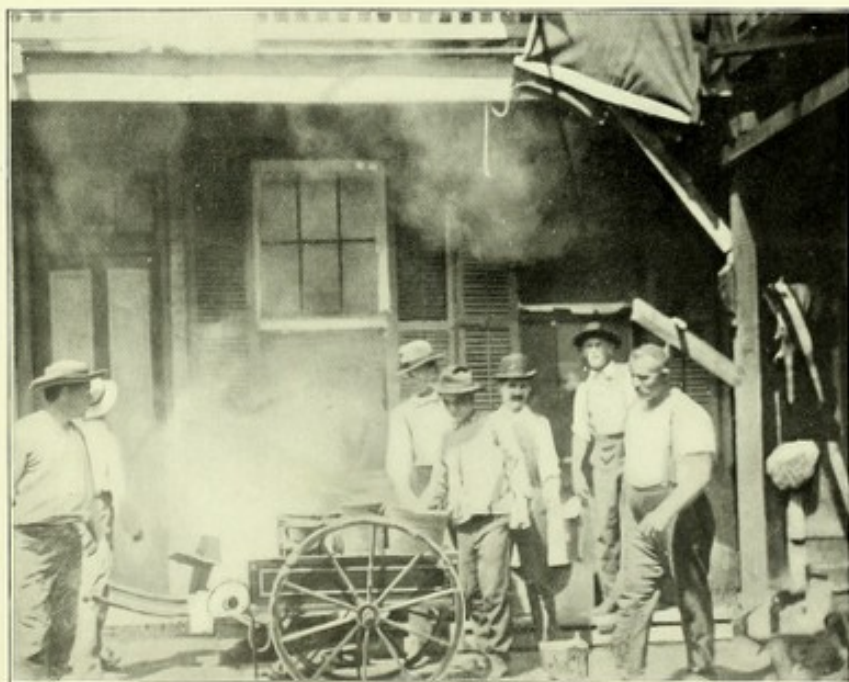


Fig. 22.

A FUMIGATING GANG AT WORK

PROPHYLACTIC MEASURES.



Fig. 23.
THE OILING GANG.

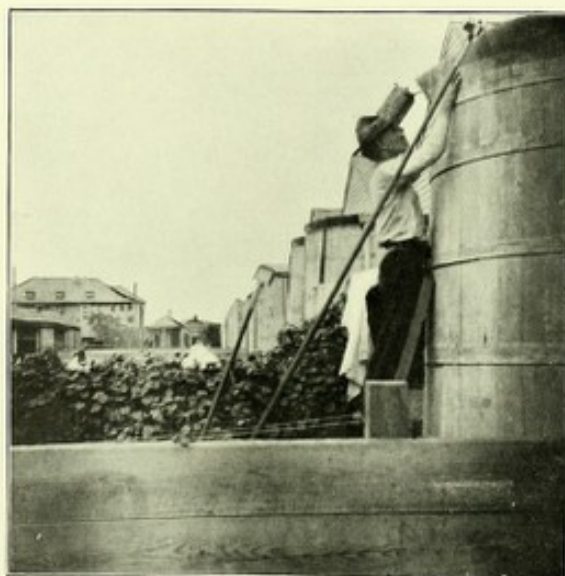


Fig. 24.
SCREENING THE CISTERNS.

PROPHYLACTIC MEASURES.



Fig. 25.

CLOSING AN ARCHWAY WITH PAPER.



Fig. 26.

AN OUTHUSE COMPLETELY CLOSED WITH PAPER.

