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PAKISTAN JOURNAL OF HEALTH

Vol : XIII

JULY, 1963

No. 2

A QUARTERLY
DEVOTED TO HYGIENE, PREVENTIVE MEDICINE,
MEDICAL SCIENCE AND ALLIED SUBJECTS,



PUBLISHED BY
THE INSTITUTE OF HYGIENE & PREVENTIVE MEDICINE
6, BIRDWOOD ROAD, LAHORE.

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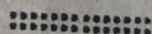
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INFORMATION

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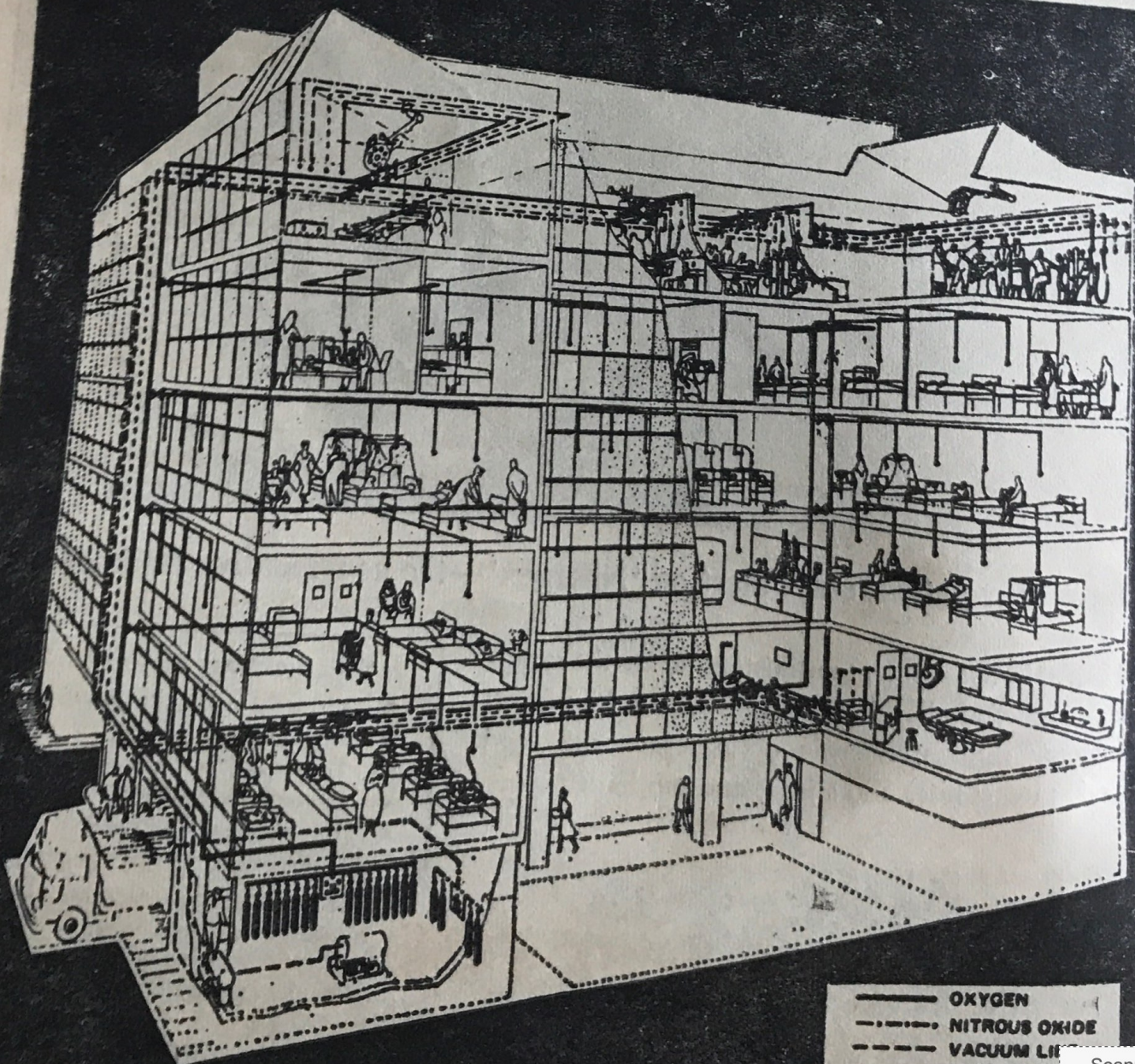
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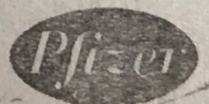
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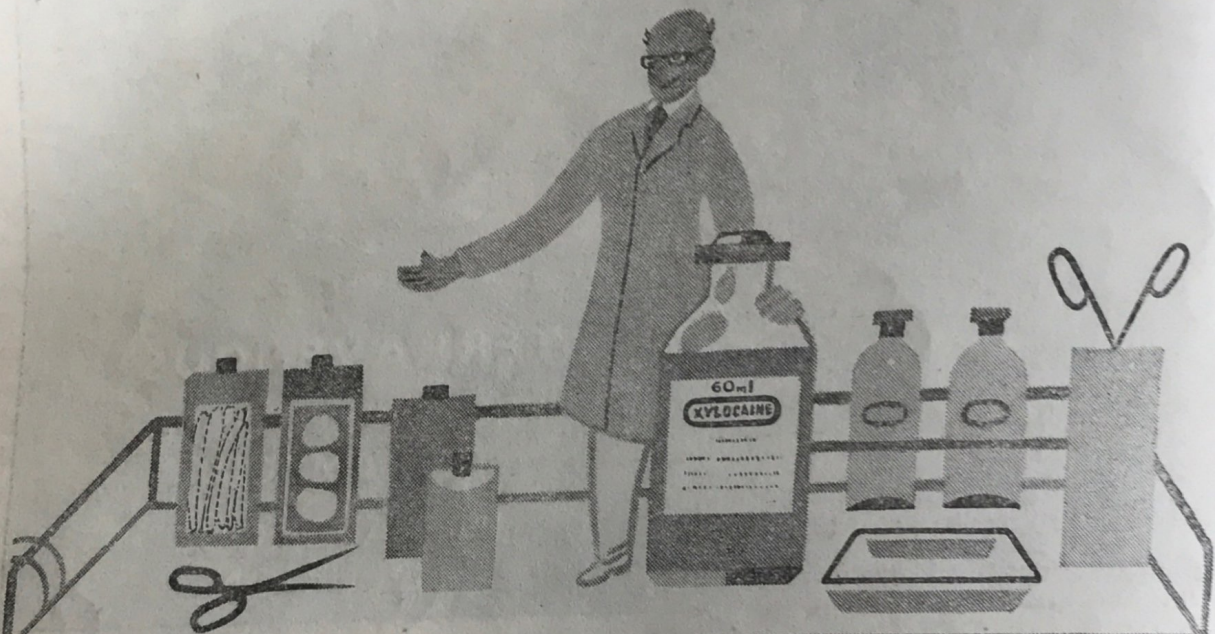
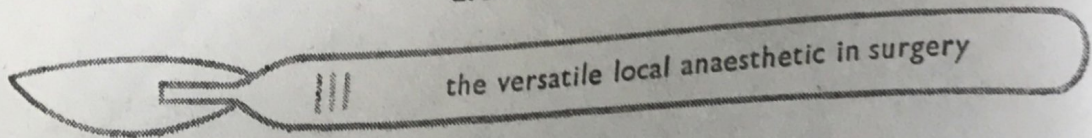


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SCRUB TYPHUS IN SIALKOT DISTRICT (WEST PAKISTAN)

By

1. DR. A. MAJID KHAN.
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Dip. Bact., (LONDON).

2. DR. SHAMIM GILANI.
MBBS., (Pb.), Dip. Bact.
(LONDON).

Health Services, West Pakistan
on 7th October 1961.

INTRODUCTION

On the 27th of September, 1961, the Medical Superintendent, Civil Hospital, Sialkot sent seven samples of blood from patients suffering from fever for serological examination. The Officer suspected typhus fever amongst the border police contingent stationed near the Indo-Pakistan border. Necessary investigations were done and significant rise of titre against proteus OXK was observed. All the sera sent revealed immune reaction against T. A. B. Medical Superintendent was informed about the probable diagnosis and was requested to send 2nd samples of blood from the same patients to detect the change in-serological behaviour. The 2nd samples of sera showed significant rise against proteus OXK antigen. Report about the epidemic of scrub typhus was sent by the senior author to the Director,

There was some doubt expressed about the diagnosis by higher authorities.

The Army Medical Authorities were treating their cases as suffering from "MODIFIED" typhoid fever. The senior author was asked to visit Sialkot area and report after personally studying the situation in the field, with the Professor of Parasitology and Medical Entomology, Institute of Hygiene and Preventive Medicine Lahore. The senior author then demonstrated the rash and eschar on one of the patients admitted to Civil Hospital, Sialkot on 12th October 1961. He also contacted the local Army Medical Authorities and convinced them about the nature of the disease. The Professor of Bacteriology submitted the report again to the Director Health Services, West Pakistan.

CLINICAL PICTURE

The onset of the disease was abrupt, fever coming on with chills, headache and dizziness. The type of fever was remittent, lasting from 5 to 27 days in the cases observed. Sweating with slight fall in the temperature was a common feature. The peak of the temperature varied from 101 °F to 106 °F. Cough and signs of respiratory catarrh were rare. Pulse rate tended to be relatively slow and the tongue was mostly furred, with raw margins. Eyes were suffused in majority of cases. Lymphadenopathy was very occasional and enlargement of the spleen too was uncommon. The characteristic red macular rash though present in some was generally not recognisable. Eschar on the body again was not observed in most of the cases.

Most of the patients were treated with chloromycetine, one capsule of 250 mg. given every four hours. The response to the anti-biotic was

excellent. The temperature came down to normal within 1-2 days. Mild relapses were observed in some cases.

A very characteristic feature of the disease was an extreme degree of prostration in majority of patients, which persisted even after the fall of the temperature. The convalescence was very protracted. Many of the patients were kept in the hospital for two weeks after the control of the temperature.

LABORATORY FINDINGS

Blood smears of eight patients were examined in our laboratory. Overall picture was of leucopaenia with relative increase of monocytes. No haemoparasites were seen.

Widal and Weil—Felix reactions were done on some of the patients on 22nd September 1961, 7th October 1961 and 18th October 1961. The results are tabulated below :

(Table : I)

Table I. Serological Investigation of patients from Border Police.

Serial No.	Names	Date	"WIDAL"											"WEIL-FELIX"		
*P. L. E. M.																
						"TO"	"TH"	"AH"	"BH"	"OX 19"	"OX 2"	"OXK"				
1.	Yara Din	.. 22-9-61	..	48	45	—	7	125	125	250	250	—	50	125		
		7-10-61	..					250	500	600	500	—	—	50		
		18-10-61	..	43	49	2	6	..	..	..	..	..	..	60		
2.	Ziarit Gul	.. 22-9-60	..	42	48	—	10	50	125	50	125	—	25	125		
		7-10-61	..					50	50	—	125	—	—	50		
.	Abdul Manan	.. 22-9-61	..	27	70	—	3	125	250	125	125	—	50	25		
		7-10-61	..					50	500	125	125	—	—	500		
4.	Gul Anwar	.. 22-9-61	..	59	37	—	4	25	50	—	50	—	50	50		
		7-10-61	..					250	125	—	50	—	—	125		
5.	Ghuncha Gul	.. 22-9-61	..	53	37	—	10	—	125	50	50	25	25	250		
		7-10-61	..					250	250	125	125	—	25	50		
6.	Syed Nabi Hassan	22-9-61	..	47	52	—	1	125	50	400	50	50	50	00		
		7-10-61	..					25	125	125	250	—	—	2500		
		18-10-61	..	56	39	—	5	—	..	..	—	—	—	10,000		
7.	M. Bashir	.. 22-9-61	..	52	45	—	3	50	50	.	25	—	125	125		
		7-10-61	..					125	125	125	500	—	25	500		
		18-10-61	..	44	54	—	2	..	..	..	..	25	25	4000		
8.	Gul Janan	.. 18-10-61	..	32	55	7	6	..	..	..	..	—	50	25		
9.	Adam Khan	.. 18-10-61	..	49	54	2	—	..	..	..	..	—	25	50		
10.	Muhammad Amir	18-10-61	..	44	54	—	2	..	..	..	..	—	—	..		
11.	Hashim Ali	.. 18-10-61	..	46	52	—	2	..	..	..	..	—	—	8000		
12.	Sher Beg	.. 18-10-61	..	35	61	—	4	..	..	..	..	—	—	25		
13.	Abdul Aziz	.. 9-11-61	..					25	125	250	250	—	125	500		
14.	Gul Mir Khan	.. 9-11-61	..					25	50	125	250	—	25	25		
15.	Allah Dad	.. 9-11-61	..					50	125	50	50	—	25	25		
16.	Bhai Khan	.. 9-11-61	..					—	50	—	25	—	25	50		
17.	Khandi Badsha Khan.	9-10-61	..					125	50	—	50	—	25	25		

*P=Polymorph.
 L=Lymphocyte.
 E=Eosinophil.
 M=Monocyte.

Widal reaction revealed previous T. A. B. inoculation. Weil-Felix reaction was positive against proteus OXK in all the sera examined and significant rise in titre was observed in some of the samples. Maximum titre of 1/10,000 against proteus OXK was observed in patient No. 6. (SYED NABI HASSAN).

In order to determine the basic antibody titre against proteus OXK in healthy individuals who were city dwellers, sera of 62 males were put up for Weil-Felix reaction. These individuals were either bearers of Hotel Shezan or they were patients attending VOD Mayo Hospital, Lahore, 44

of 62 were completely negative against proteus OXK. Out of the remaining 18, 16 were positive up to the titre of 1/20 and the other two in 1/40,

As the non-specific agglutination antibody against proteus organism disappears rapidly after the illness, data was collected of Weil-felix reaction carried out in the Department of Pathology, King Edward Medical College, Lahore, The objective was to find out the behaviour against proteus OXK of patients suffering from suspected typhoid fever. The result are tabulated below:—

Table II

Table II Weil Felix Test of patients Suspected of Typhus Fever Mayo Hospital Lahore.

Year	No. of cases examined	OXK +	OXK— OX2+ OX19+	OXK+ OX2+ OX19+	Negative
1949	15	..	..	11	14
1950	5	4	..	..	..
1951	24	3	..	1	20
1952	6	..	..	..	6
1953	2	..	..	..	2
1954	2	..	..	..	2
1955	1	..	..	..	1
1956	..	..	..	..	3
1957	..		..	..	2
1958	..	..	..	..	1
1959—62	..	..	..	..	..
Total	61	7	..	12	..

June, 1963

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Final agglutination titre of positive cases mentioned above are given below :—

OXK + Cases

Titre	1/50	1/25
No. of cases	4	3

Scrub typhus cases are not expected to be prevalent in the city due to obvious reasons but as there are quite a few scrub areas around

the city of Lahore on the banks of river Ravi where scrub typhus could be possible, these data were taken from the Mayo Hospital (Pathology Laboratory).

The Medical Authorities of Sialkot were requested to send the samples of blood from civilian population in the area where scrub typhus was prevalent. Sera of eight patients suffering from fever were sent for Weil-Felix and Widal reactions. The results are tabulated below :—

Table III. Serological investigation of Civilian Population from Sialkot District suspected of Typhus Fever.

Serial No.	Namee	Date	"WIDAL"				"WEIL-FELIX"		
			"TO"	"TH"	"AH"	"BH"	"OX19"	"OX2"	"OXK"
1	Fakhar Din ..	8-11-61 ..	..	..	..	..	25	..	50
2	M. Sadiq ..	8-11-61 ..	..	..	..	..	..	..	500
3	A. Ghaffar ..	8-11-61 ..	..	..	..	..	125	..	50
4	Ghaur ..	8-11-61 ..	..	..	..	..	..	..	5000
5	Ghani Shah	23-9-61 ..	..	50	125	250	50	..	500
6	Bashir Ali ..	23-9-61 ..	51	125	50	125	25	..	500
7	Mian Khan	23-9-61 ..	25	250	125	125	25	..	500
8	Musaffar Khan	23-9-61 ..	25	250	125	125	..	..	500

As was expected scrub typhus was diagnosed in some of the patients. Titre 1/5000 against proteus

OXK was obtained in patient No. 4. (GHAUR).

EPIDEMIOLOGY

Epidemic typhus has been reported from various parts of West Pakistan. These reports have been made by the District Health Officers of various districts and their records maintained in the West Pakistan Health Secretariat. Cases of epidemic typhus have been reported in Dera Ghazi Khan, Quetta, Hindubagh, Dera Ismail Khan, Hazara, Kohat, Bannu, Khyber, Kurram and Malakand Agencies. The Secretariat record dates back to 1947. During the years 1946 -1956, 5968 cases were reported from the Peshawar region, 46 cases with eight deaths occurred in 1956 in Dera Ismail Khan. The epidemics invariably occurred in winter and were closely correlated to the influx of Powindas from Afghanistan. Subsequent to this finding UNICEF started an extensive delousing program both of Powindas and in the general population in the frontier areas. These extensive delousing programmes and the prohibition of the Powindas in West Pakistan has achieved the desired goal. There have been no epidemics since 1957. The diagnosis of louse born typhus has been purely on clinical and epidemiolo-

gical basis. In some cases only Weil-Felix reaction was done which was positive to significant titre against proteus OX 19 antigen. The organism has never been isolated. More specific serological tests have not been carried out due to the lack of laboratory facilities. Col. Nur Ahmad has been working in the Armed Forces, Institute of Pathology, at Rawalpindi, and he believes that these epidemics were more likely due to flea borne typhus. His observations are based on the specific serological reaction against *R. mooseri*,

Flea borne typhus has sporadically been reported in West Pakistan and laboratory diagnosis was confirmed in some cases by Col. Nur Ahmad and his team. As the non-specific Weil-Felix reaction against proteus OX 19 antigen cannot differentiate between louse borne typhus and flea borne typhus, the epidemics of typhus reported in West Pakistan have been purely diagnosed on clinical and epidemiological basis.

Scrub typhus has not been reported in West Pakistan before this epidemic broke out in the Rangers and the Pakistan Army. For that

reason clinical diagnosis was not suspected by either the civilian or Military Medical Officers. The disease was clinically spotted by the senior author as he had seen a large number of patients suffering from scrub typhus during the 2nd World War in South East Asia command. The rash and eschar which was missed clinically by the Medical Officers in the present epidemic could be due to lack of experience. In our laboratory the diagnosis has been based purely on Weil-Felix reaction. Col. Nur Ahmad and Col. Burney have tried to isolate the *Rickettsia* from the patients and the trapped rodents in the field and they have had some success.

After our visit to Sialkot Mr, A. S. Nasir, Entomologist, attached to the Institute was sent to trap the rodents for the identification of the vector responsible for this disease. From many of these rats mites were recovered which were subsequently identified by him and Professor of Parasitology and Medical Entomology of our Institute as *Trombicula delienses*.

SUMMARY AND CONCLUSION

There was a sharp outbreak of scrub typhus in the Border

Police and Pakistan Army Troops in 1961. The disease was diagnosed for the first time in West Pakistan. The diagnosis has been mainly done on the basis of clinical pattern and Weil-Felix reaction. The disease seemed to be endemic in the area occupied by the troops as evident from the positive serological behaviour of some of the civilian patients of that area. The disease was comparatively mild with no death. Response to chloromycetine has been dramatic. The vector responsible for the scrub typhus in this region is *Trombicula delienses*. The disease has been clinically missed by the Medical Authorities due to the excellent response to the anti-biotics. This should serve as an eye-opener for all of us that every P. U. O. is not enteric fever but could be something else. Organisation of good Public Health Laboratory service is over due in this country and all these pitfalls have been due to lack of such a service.

ACKNOWLEDGMENT :

We are grateful to the Dean, Institute of Hygiene and Preventive Medicine, Lahore, and the Director, Health Services, West Pakistan to

give us an opportunity to study the epidemic. We are grateful to Col. Nur Ahmad and Col. Burney of Armed Forces Institute of Pathology Rawalpindi, with whom we had valuable discussion. The most deserving individual to whom we are grateful is Dr. M. Hayat, Medical Superintendent, Civil Hospital, Sialkot, who was the first one to point out that the epidemic could be some sort of typhus fever. With out his assistance the disease would have been burried as "MODIFIED TYPHOD" fever, We

are also grateful to Dr. Miss Farida Mir, Demonstrator in Bacteriology, for her help in performing the laboratory work.

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- *1, Majid Khan A. Report to D. H. S., October, 1961.
- 2, Nur Ahmad and Burney M.I. "A preliminary Report on Field Studies and Isolation of Rickettsial Strains from Sialkot Area" Armed Forces Medical Journal July, 1962, No.-III., Vol, XI p. 102—107.

A COMPARATIVE STUDY OF TUBERCULINS (P.P.D.) OF DIFFERENT ORIGIN.*

SECOND REPORT*

By

MOHAMMAD IQBAL YAD,

M.B.B.S., (Pb.) T.D.D. (WALES), M.R.C.P.

Director,

Tuberculosis Control and Training Centre, Karachi.

A preliminary report on the comparative study of P. P. D. Tuberculin R. T. 23 prepared by the Serum Institute, Copenhagen, (Danish Tuberculin) and P. P. D. Tuberculin issued by Parke Davis & Co. of the United States (American Tuberculin) was presented in the clinical session of the Founder's Day Celebration of Muhammad Hussain Tuberculosis Sanatorium, Samli, in 1961. The Tuberculosis Control and Training Centre Karachi, has been using the Danish Tuberculin since 1958. It was observed that 14 out of 500 bacteriologically proved cases of tuberculosis showed negative tuberculin reaction. The cases of false negative reaction were reviewed and it was found that these false

negative reaction could not be explained on any of the known causes. As it was a new tuberculin it was decided to make a comparative study of the Danish tuberculin with the American tuberculin. The preliminary report indicated that there was no significant difference between the reactions obtained with Danish tuberculin and the American Tuberculin. However, as the numbers included in the report were too small to be significant, it was decided to conduct a second trial with enlarged number of subjects in each group. As in the preliminary study, in the second study also the same plan of experiment was used. The following strengths were used and they

* Read at the All Pakistan Science Conference, held at Peshawar, in March, 1962

were assigned the same code letters as in the first study : -

PPD.—RT.-23	.. 1. t.u. ...	A
PPD.—R.T. 23	.. 2. t.u. ...	B
PPD. Parke—		
Davis	.. 5. t.u. ...	X
P. P. D.—Parke—		
Davis	.. 10 t.u. ...	Y
P. P. D.—Parke—		
Davis	.. 1. t.u. ...	Z

Same diluent was used for preparing dilutions, except that Tween—80 was not used for Parke—Davis Tuberculin.

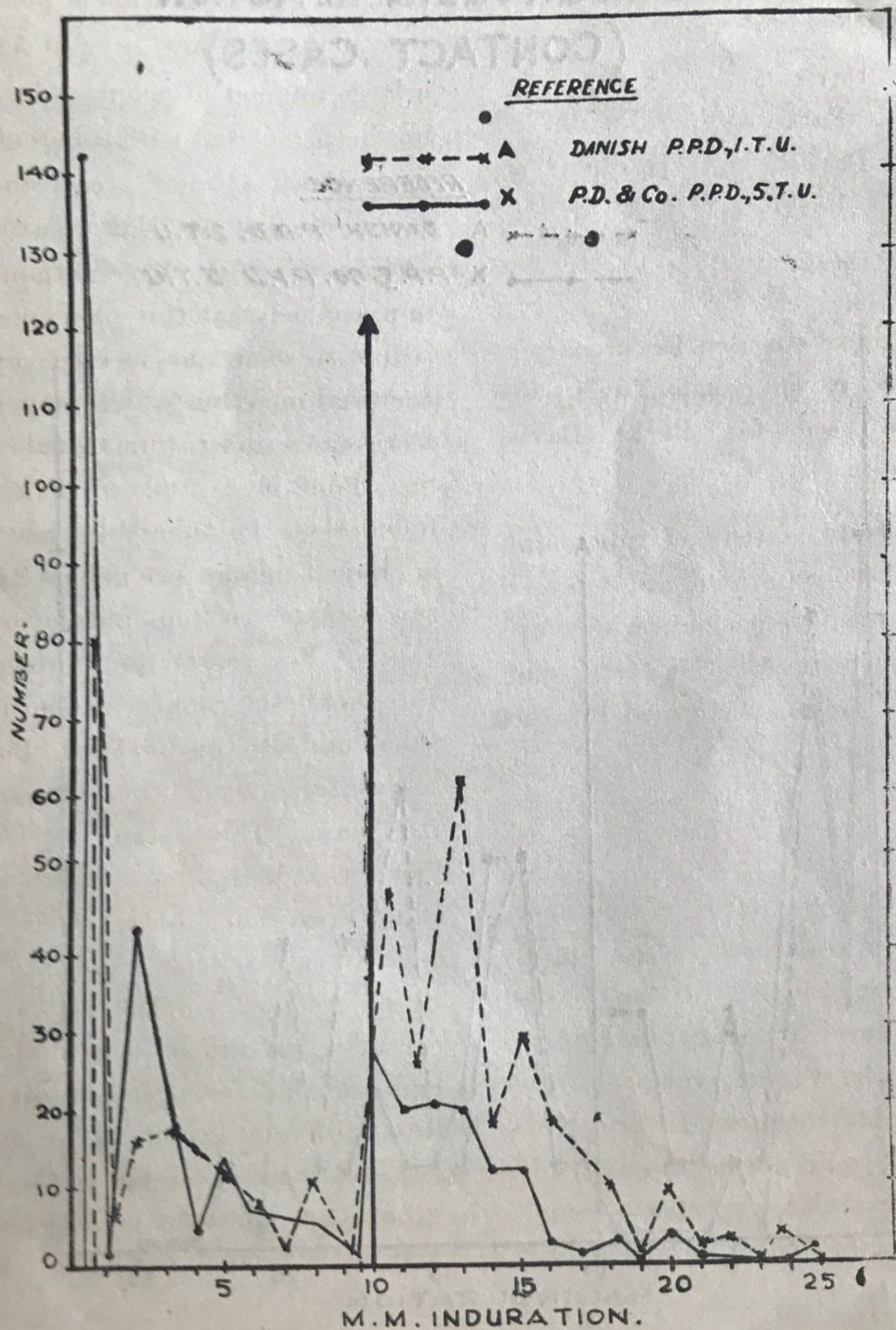
This study consists of tuberculin testing of 5684 school children and 500 consecutive patients with positive sputum. All the tests and readings were performed by the same person.

Positive Tuberculin Reaction:

The old standard of positive tuberculin reaction is induration of 5 mm. or above. In the WHO BCG. Vaccination Campaigns it was noticed that in various areas scattered throughout the world this criterion could not be adopted. In these areas a large number of people fell in a group which showed a small

reaction to a small dilution of tuberculin, and the sharp distinction between negative and the positive could not be made at 5 mm. induration. If the criterion of positive reaction is kept low, say, at 5 mm. a large number of people who had not been infected with tuberculosis may show a small reaction to tuberculin and may thus be excluded from the BCG. Vaccination. It is presumed that this phenomenon is due to some non-specific mycobacterial infection which may give a cross reaction to human tuberculin. Piot² in a study in Pakistan found that the tuberculin reaction of clinical significance in East Pakistan was of 10 mm. induration or above. For reason of uniformity throughout the country the positive tuberculin reaction for West Pakistan was also fixed at a minimum of 10 mm. This study confirms Piots' Graph 1 represents tuberculin reaction both with 'A' and 'X' in school children and Graph 2 shows similar test in the contacts. It will be seen that the bulk of the cases can be divided into 2 different groups. The majority of the cases falling in the first group show induration of 0 to 5 mm. and in the second group they show

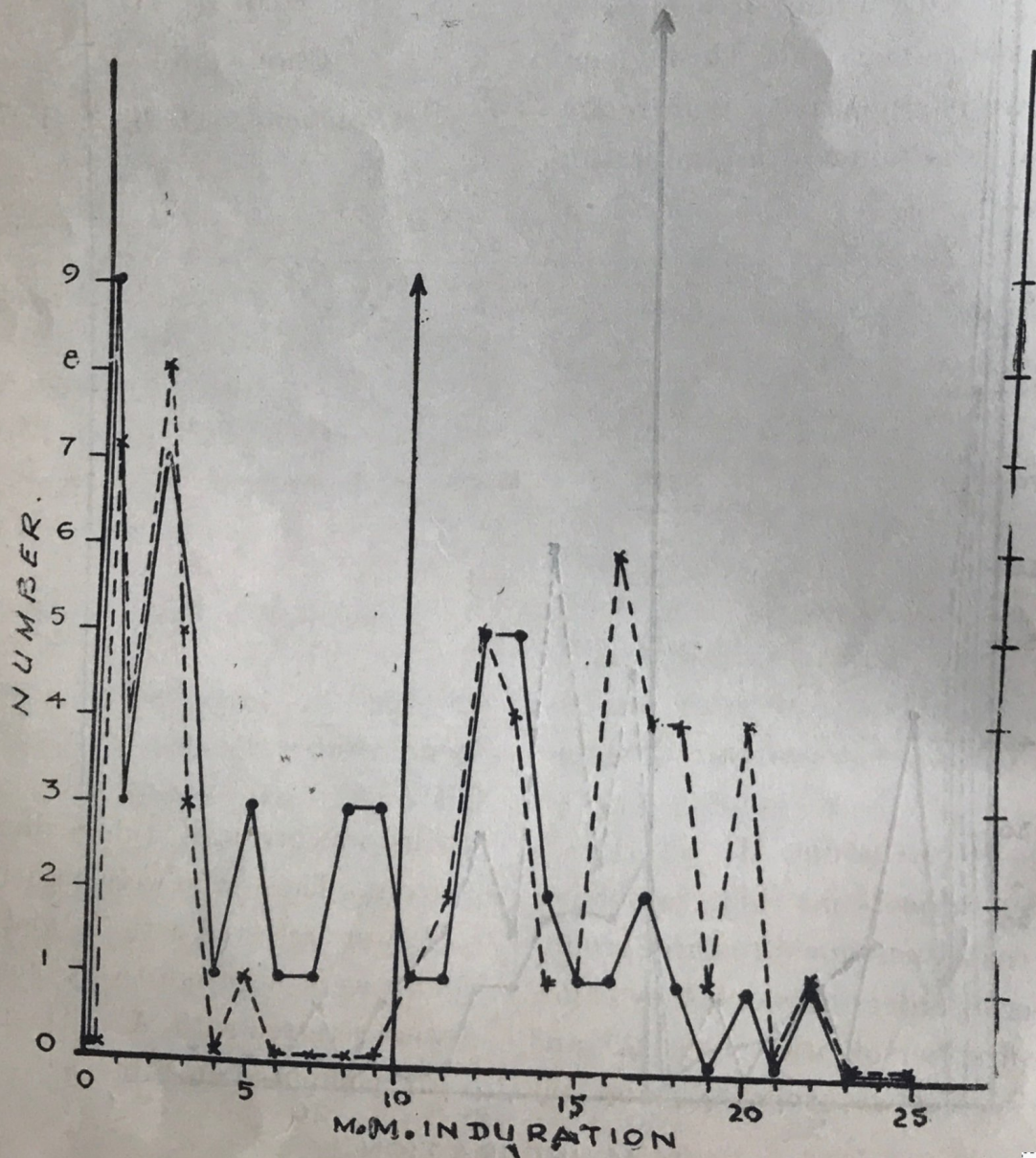
GRAPH NO. 1 TUBERCULIN RE-ACTION (SCHOOL CHILDREN)



GRAPH No. 2

TUBERCULIN RE-ACTION
(CONTACT CASES)REFERENCE

- * - * - * A DANISH P.P.D. 1.T.U.
 — • — X P.P.&CO. P.P.D. 5.T.U.



an induration of 10 to 15 mm. There is sharp rise at induration of 10 mm. whereas the reading of 9 mm. is zero. Only a small section of cases show an induration of 5 to 8 mm. Similarly in Sputum positive cases, tuberculin reactions show indurations of 10 mm. or more in over 90% of cases. It can be presumed therefore, that reactions of 10 mm. or above indicate tubercular infection and those with 9 mm. or below can be classed as negative. Throughout this study positive tuberculin reaction was taken at an induration

of 10 mm. or above.

Group : I.

In this group of 712 school children, 373 were tested with 'A' and 335 with 'X'. Those who were negative to 'A' were retested with 'B' and those negative to 'X' were retested with 'Y'. The results are given in table 2.

TABLE : II.

GROUP : No. I

(Reactions to A, B, X, Y.)*

BATCH I—	<i>Tested</i>	<i>Positive</i>	<i>Negative</i>	<i>Retested</i>	<i>Positive</i>	<i>Negative</i>
Tested with 'A' and negative retested with 'B' ..	373	123	250	217	18	199
		33%	66%		8.3%	
BATCH II—						
Tested with 'X' and negative retested with 'Y' ..	410	250	164	148	12	136
		61%	39%		8%	

A=Danish 1 t.u. B=Danish 2 t.u. X=American 5 t.u. Y=American 10 t.u.

GROUP : II.

982 subjects in this group were alternately assigned to three groups in serial orders in which they came. The first person was given 'A' and the second was given 'X' and the

third was given 'Z' tuberculins and so on. Those who were negative to 'A' were retested with 'X' and those who were negative to 'X' (or 'Z') were retested with 'A'. The results are computed in table 3.

TABLE : III.
GROUP—No. II
(Comparing A, X, Z.)

		<i>Tested</i>	<i>Positive</i>	<i>Negative</i>	<i>Average Induration in mm.</i>
A	..	358	112 31.3%	246	10.3mm.
X	..	224	77 34.4%	147	8.2 mm.
Z	..	400	77 19.25%	323	7.3 mm.
<i>Retested—</i>					
Negative to 'A'					
	retested with				
'X'	..	246	76 31%	170	
Negative to 'X'					
	retested with				
'A'	..	146	12 9%	134	
Negative to 'Z'					
	retested with				
'A'	..	228	21 9%	207	

A = Danish 1 t.u. X = American 5 t.u. Z = American 1 t.u.

GROUP—III.

In this group 843 school children were tested with tuberculin 'A' those negative were alternately assigned to one batch which was retested with 'B' and the other batch was retested with 'Y' and the results are shown in Table—4.

TABLE : IV.

GROUP—III.

Comparing B & Y (Simultaneous)

<i>Tested with A.</i>	<i>Total</i>	<i>Positive</i>	<i>Negative</i>
Negative to 'A' ..	843	254	589
Retested with 'B' ..	234	14	220
		6%	
Negative to 'A' ..	215	24	191
Retested with 'Y' ..	..	11%	..
A = Danish 1 t.u., B = Danish 2 t.u., Y = American = 10 t.u.			

GROUP—No. IV.

In this group 888 school children were include which were simultaneously tested with 'A' on the left fore-arm and 'X' on the right fore-arm and the results are shown in Table—5.

TABLE : V.

GROUP—IV.

Comparing 'A' and 'X' (Simultaneous).

	A		X	
	<i>Positive</i>	<i>Average Induration</i>	<i>Positive</i>	<i>Average Induration</i>
No. of cases tested:—888 :	227	7.5 mm.	241	6 mm.
	25.6%		27.1%	

A = Danish 1 t.u., X = American 5 t.u.

GROUP— V.

In this group 835 subjects were divided into two batches and the the first batch of 466 were tested with 'A'. Of these 277 were found to be negative and retested with 'B'. Of these, 137 who were still found to be negative were retested with 'Y'. The next batch consists of 369 persons were tested with 'X'. Of these, 168 found to be negative were tested with 'Y'. Of these 127 who were still negative were retested with 'B'. The results are shown in Table 6.

TABLE VI.
(Comparing B & Y)

BATCH : I.

		Total	Positive	Negative
Tested with 'A'	..	466	161	305
Negative to 'A'				
Retested with 'B'	..	277	50	227
Negative to A & B Retested with 'Y'	..	137	10	127
			7.3%	

BATCH : II

Tested with 'X'	..	369	164	205
Negative to 'X'				
Retested with 'Y'		168	1	167
Negative to X & Y, Retested with 'B'	..	127		127
			0%	

A=1 t.u. B=2 t.u. Y=10 t.u. X=5 t.u.

GROUP : No. VI

738 subjects were divided into two batches. The first batch of 357 cases were tested with 'A'. of those found negative to 'A', 178 were tested simultaneously with 'B' on the left fore-arm and 'Y' on the right fore-arm. The second batch of 381 persons were tested with 'X'. Of these found to be negative to 'X', 130 were retested simultaneously with 'B' on the left fore-arm and 'Y' on the right fore-arm. Results are given in Table : 7.

TABLE : VII
(Comparing B & Y (simultaneous))

GROUP : VI

Batch—1		Total	Positive	Negative	Average Induration		
Tested with 'A'	..	357	158	199	10 mm.		
		B		Y			
		Positive	Negative	A. Induration	Positive	Negative	A. Induration
Negative to 'A' retested with B & Y simultaneously.		178	169	5.2 mm.	9	169	5.6 mm.
		9%			5%		

<i>Batch—II</i>	<i>Total</i>	<i>Positive</i>	<i>Negative</i>	<i>Average Induration</i>			
Tested with 'X'	381 B	187	194 Y	10.7 mm.			
<i>Average In-</i>							
<i>Total</i>	<i>Positive</i>	<i>Negative</i>	<i>duration</i>	<i>Positive</i>	<i>Negative</i>	<i>duration</i>	
Negative to 'X'	130	10	120	5.8 mm.	10	120	5.9 mm.
retested with	7.7%			7.7%			
B & Y							

A = Danish 1 t.u., B = Danish 2 t.u., X = American 5 t.u.
Y = American 10 t.u.

A study was made of tuberculin reactions in 500 cases, (222 females and 278 males) bacteriologically and radiologically proved to be suffering from tuberculosis. Of these 14, i.e., 2.8% were found tuberculin negative. The results are given in Table 8.

TABLE : VIII

	<i>Total</i>	<i>Tuberculin Positive +</i>	<i>Tuberculin Negative —</i>
Males ..	278	271	7 2.6%
Females ..	222	215	7 3.3%
Total ..	500	486	14 2.8%

These 14 tuberculin negative cases were reviewed for their X-Ray shadows and the results are given in the table 9. None of these cases was found in low general condition.

TABLE : IX

<i>Age</i>	<i>Minimum</i>	<i>Moderate</i>	<i>Advanced</i>	<i>Total</i>
0 -14 ..	0	0	1	1
15 -35 ..	0	3	6	9
35 and above ..	1	0	3	4
Total	1	3	10	

DISCUSSION

In the study of sputum positive cases made now, it was found, as in the first report, that about 3% of the confirmed tuberculosis cases were tuberculin negative. The reactions were the same with American and Danish Tuberculins. An analysis of these cases revealed that the 10 out of 14 had advanced lesions. 9 out of these 14 tuberculin negative cases were in the age group of 15 to 35 which is the commonest age group of the tubercular cases registered in the Tuberculosis Control and Training Centre, Karachi. As none of these cases were very weak or moribund, the depressed tuberculin reaction could not be attributed to the overwhelming infection. But it can be assumed that in persons with general tendency of low tuberculin reaction the advanced lesions may further depress and give lower tuberculin reaction.

The comparison of the Danish tuberculin P. P. D—R. T. 23 and American Tuberculin, Parke Davis P. P. D., does not show superiority of one against the other. In the school children, the American tuberculin shows slightly better result

as compared with the Danish Tuberculin in that over—all 66% were found positive as against 32.5% to the two strengths of Danish Tuberculin, but these tests were given in two different batches comprising of 410 and 373 children respectively.

Whereas in the second group of 572 children 31.3% were positive to Danish tuberculin with an average induration of 10.3 mm., 34.4% were positive to the similar strength of the American tuberculin with an average induration of 8.2 mm. One tuberculin unit of Danish Tuberculin compares well with 5 tuberculin units of American tuberculin. American tuberculin in the strength of 1 t. u. shows inferior reactions, only 19.25% were positive with an average induration of the 7.3 mm. Of 248 children who were negative to Danish Tuberculin, 76 (31%) reacted to the American Tuberculin. On the other hand, only 12 or (9%) of 146 children negative to American tuberculin reacted to the Danish tuberculin. In the third group of the children which were negative to Danish tuberculin and were simultaneously tested with the

second strength of Danish tuberculin on one arm and the second strength of American tuberculin on the other arm, the positive reaction rate with second strength of Danish tuberculin was 6%, whereas that with the second strength on American tuberculin was 11%. In the simultaneous test of Danish and American tuberculin, in the same children with Danish tuberculin on the left arm and the American tuberculin on the right arm, the reaction rate was 25.6% in the case of Danish tuberculin with an average induration of 7.5 mm. and 27.1% in the case of Parke Davis tuberculin with an average induration of 6.5 mm. In group VI, 357 children were tested with Danish tuberculin and 178 children with negative reaction were retested simultaneously with second strength of Danish tuberculin on the left arm and second strength of the American tuberculin on the right arm. The reaction rate was equal and average induration was similar in both the case.

SUMMARY AND CONCLUSIONS

This small experiment has shown that there is no significant difference in reaction to a dose of 1 Inter-

national tuberculin unit of Danish R. T. 23 tuberculin as compared with its equivalent strength of 5 tuberculin units of American Parke Davis P. P. D. for purposes of diagnosis or screening for B.C.G. Vaccination campaign. The negative tuberculin reaction in tubercular patients is probably due to natural causes and perhaps due to influence of massive tubercular infection. A few cases will however continue to give negative reaction to whatever type of tuberculin is used even though they have been suffering from tuberculosis.

It has also been shown that an induration of 10 mm. or above can safely regarded as a positive tuberculin reaction for purposes of diagnosis and B.C.G. Campaign.

Acknowledge :

The American P. P. D. Tuberculin was supplied free of cost by the Parke Davis & Co., The tests and readings were performed by Mr. Muhammad Rafique B.C.G. Technician.

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A STUDY OF DRUG RESISTANCE IN NEWLY DIAGNOSED CASES OF PULMONARY TUBERCULOSIS

By

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The advent of Chemotherapy has revolutionized the treatment and management of tuberculosis. Before the Streptomycin era, the best a treating physician could achieve was to stabilize the lesions, render the patient non-infectious, if possible, and make him fit for restricted activity. Relapses were frequent and complete cure rare. With the use of specific antitubercular drugs we can now hope for complete amelioration in symptoms, clearing of chest-X-ray shadows, healing of cavities and sputum conversion. Ross and Others¹ have shown that it is possible to sterilize a case and keep him sterilized with the use of drugs. Madras Chemotherapy Trial² has shown that a case can be treated as well in his home as in the hospital. The need of bed rest, hospitalization and rehabilitation though still present is not so pressing

as it used to be. The impact of Chemotherapy has resulted in downward trend in tuberculous morbidity in many countries. The antitubercular drugs are, therefore not only of therapeutic but also of great preventive value.

Unfortunately, soon after the use of Chemotherapy had gone under way, it was found that bacillary population in patient's body was soon replaced by their drug resistant mutants. In such patients the disease relapsed and in spite of continued use of the same drug the disease followed its remorseless course. (M. R. C. Trial, 1948³, Carstensen 1950⁴, M. R. C. Trial -1953⁵), These resistant index cases could infect other healthy people especially children with drug resistant bacilli. These new cases with primary drug resistance could not be benefited by

the antitubercular drug (Debre & Others, 1959⁶). The bogey of drug resistance could however, be defeated with the use of combined drug therapy.

Iso-nicotinic-acid-hydrazide (INH) Streptomycin (Sm) and Paramino-salicylic acid (PAS) are still the most effective and the cheapest drugs available. Other drugs, like Pyrazinamide, Viomycin, Cycloserine etc. are not as effective, are far too toxic and prohibitive in cost.

However, whatever efforts are brought to bear, there are bound to be a few cases which harbour resistant bacilli. It is, imperative that Chemotherapy of patients is so planned that drug resistance is kept at minimum. Our country cannot afford the costlier drugs. As anti-tubercular drugs are easily available and for various reasons not properly used, drugs resistance, both primary and secondary, poses problems of management in most countries of the world to day. (East African Chemotherapy Trial⁷, M. R. C. Survey in Great Britain⁸, Chemotherapy Trial in Nigeria).⁹

No information is available as to what extent this problem exists in Pakistan. In Tuberculosis

Control and Training Centre, Karachi, in a sample of 100 consecutive cases registered in 1960, 55 did not show satisfactory response to treatment (Yad 1961).¹⁰ It was felt that the information on the sensitivity status of our cases was necessary in order to tailor the Chemotherapy according to individual need of the patient. It was, therefore, decided to subject all positive specimens of sputum obtained from the patients attending the Centre to the sensitivity test against the three standard antitubercular drugs, i.e. Streptomycin, INH. and PAS.

This test was started as a routine in our Laboratory in March, 1961.

MATERIAL AND METHODS

A fresh spot sample of sputum from every newly diagnosed case is collected in sterile wide mouth bottle and tested by direct smear and culture on Lowenstein-Jensen slopes. In children who do not cough up sputum, the specimen for primary culture is obtained by laryngeal swab. For the primary cultures Nassau's technique is used. Positive cultures are subcultured on ten slopes, first serving as control and the other slopes incorporating 3 strengths

of Streptomycin, INH, and PAS, in solid media. The technique of preparation of media and of performing sensitivity tests has been borrowed from Public Health Reference Laboratory of Cardiff (Director, J. Marks), and is rigidly adhered to. The following strengths of drugs is used in the media :—

Sm. 10, 20 and 40 ug/ml.

PAS. 1, 2 and 4 ug/ml.

INH : 0.2, 0.4 and 0.8 ug/ml.

Results :

This paper presents a preliminary report on drug sensitivity tests on newly diagnosed cases from March, 1961 to November, 1961. During this period 5975 cases were registered in Tuberculosis Control and Training Centre, Karachi, with chest X-Ray abnormalities. Of these, 1035 cases were sputum positive and 434 showed resistance to one or more antitubercular drugs. 96 cases were totally resistant to INH, 107 to Streptomycin and 238 to PAS. Primary drug resistance was found largest against PAS.

TABLE : 1

Total cases Registered	5975
Sputum negative ..	4940
Sputum positive ..	1035 (16%)

Total cases Resistant 434 (41.9%)

Cases Resistant Strep-

tomyacin .. 107 (10.3%)

Cases Resistant to

INH. .. 96 (9.3%)

Cases Resistant to

P. A. S. .. 231 (22.3%)

Cases Resistant to one

drug only ... 171 (16.5%)

Cases Resistant to two

drugs .. 153 (14.8%)

Cases Resistant to

three drugs .. 110 (1%)

In every case registered, history of previous treatment with anti-tubercular drugs was obtained and recorded. The cases were treated on ambulatory basis and were issued drugs, free of cost, from the Centre. It was our practice at the time to give all the three drugs only where there was a history of previous treatment or in acute cases. Otherwise every case received INH 300 mg and PAS 10 gms. daily. The cases were assessed after every 3 months. Chemotherapy was modified at the end of three months in accordance with report of sensitivity tests.

Of the 434 resistant cases, 110 were found resistant to all the three drugs : 33 were fully resistant and

77 partially resistant to at least one of the drugs. (Table (2).

TABLE : 2

Resistent to 3 drugs.	
Fully resistant to all; the 3 drugs	.. 33
Partially resistant to one or more drugs	.. 77

The effect of treatment on these cases is given in Table 3 A and B.

TABLE : 3 A.

Effect of Treatment in cases Re-	
sistent to 3 drugs.	
Fully resistant 33 cases.	
History of previous treatment :	
3 cases.	
Absentees	.. 20
Observed	.. 13
Progress	.. 4 (30.8%)
I, S. Q.	.. 7
Regress	.. 2 (15.4%)

TABLE : 3 B

Effect of treatment in cases partially resistant to 3 drugs.

Total number of	
cases	.. 77
History of previous	
treatment	.. 3
Absentees	.. 45
Observed	.. 32

Pogress;	.. 9 (28.1%)
I. S. Q.	.. 15
Regress	.. 8 (25%)

Progress = Increase in X-Ray shadows

Regress = Decrease in X-Ray shadows

I. S. Q. = No significant change in X-Ray shadows.

There was one interesting case in this series. This case was resistant to Sm. in 2nd strength and fully resistant to INH and PAS. On PAS and INH treatment he showed regress in X-Ray shadows after 3 months and further regress at the end of 6 months. The second sensitivity test showed him to be sensitive to all the three drugs.

The routine treatment for most cases in our Centre was PAS and INH. The effect of this treatment in cases resistant to these 2 drugs is given in Table 4.

TABLE : 4

Effect of treatment on cases re-	
sistent to PAS and INH.	
Total number of cases.	86
History of previous	
treatment	.. 1
Absentees	.. 49

Observed	.. 37
Progress	.. 6 (16.2%)
I. S. Q.	.. 15
Regress	.. 16

Of these 16 cases 10 received Streptomycin to which these cases were sensitive.

The effect of treatment on cases which were resistant to Sm. and one other drug is shown in Table 5. These cases received at least one drug to which they were sensitive.

TABLE : 5

Total No. of cases	.. 27	History of previous treatment-3
Absentees	.. 12	
Observed	.. 15	
Progress	.. 2 (13.3%)	
I. S. Q.	.. 7	
Regress	.. (40%)	

Sixteen cases were resistant to Sm. only. The effect of treatment is shown in Table 6.

TABLE : 6

Effect of treatment (P+H) on cases resistant to Sm. only.

Total No. of cases	.. 16	history of previous treatment
		Nil.

Absentees	.. 10
Observed	.. 6
Progress	.. Nil (0%)
I. S. Q.	.. 1 (Received Sm. + INH).
Regress	.. 5 (Received PAS + INH).

If we exclude the case who received Sm, 100% cases regressed on P+H.

Seventeen cases were found resistant to INH. only. But none of the strains belonged to the yellow variety. The effect of treatment is shown in Table 7.

TABLE : 7

Effect of treatment in cases resistant to INH only.

Total No. of cases	.. 17	history of previous treatment
		Nil.
Absentees	.. 11	
Observed	.. 6	
Progress	.. 1 (16.6%)	Received PAS + INH, Regress at end of 3 months, progress at the end of 6 months.
I.S.Q.	.. 3	
Regress	.. 2 (33.3%)	

The largest number of cases resistant to one drug only were 150 cases resistant to PAS. The effect of treatment is shown in Table 8,

TABLE: 8

Effect of treatment in cases resistant to PAS only.

Total No. of	
Cases	.. 150 history of previous treatment
	11.
Absentees	.. 82
Observed	.. 68
Progress	.. 8 - 4 cases resistant to second strength PAS received P+H- at 3 months I. S.Q. at 6 months -progress. 2 cases fully resistant to PAS received P+H, at 3 months: progress; at 6 months further progress. One case fully resistant to PAS—received P+H, regress at 3 months received

S & H, for next next 3 months progress.

I. S. Q.	.. 24
Regress	.. 36—(12 did not received PAS but S+H). 23 received P+H. 1 received S+P.

DISCUSSION

Although every patient registered was specifically asked if he had taken anti-Tubercular treatment before, such history of previous treatment was obtained only in 12 of 434 resistant cases. In reviewing the cases who had received drugs prior to registration, it was found that none of them had been adequately treated. Six of these had had Streptomycin alone varying from 15 to 150 Gms. Six cases had received a combination of Sm. and INH, but the treatment was interrupted in "COURSES" and in some cases INH was taken alone in between "COURSES" of Streptomycin. Information is not available on dose regime of Streptomycin, but one G twice a week at least in

stages of the cases is quite popular with some doctors. One case received INH alone and two cases INH and PAS irregularly. The rest (6) received Sm. INH and PAS in various permutations and courses.

Of a total of 5975 cases registered 434 cases showed drug resistance. If we exclude previously treated cases the primary drug resistance is found in 413 i.e. 40.4% cases which compares with 5.1% in Great Britain, 8% in Kenya and 12% in Nigeria and an average of 6.5% in 14 countries included in International Union Against Tuberculosis Survey (1960)⁹.

By now, there is not much doubt that drug resistance is significant in treatment of tuberculosis. On going through the result of treatment on various groups outlined above it is obvious that where the bacilli were sensitive to the drugs used, the result were better than otherwise. In the group which were fully resistant to all the three drugs, Chest X-Ray improvements has been noticed in only 2 of 13 cases (15%) but in the same group where cases were not fully resistant, 8 out of 32 i.e. 25% cases showed regress

In cases which were resistant to INH and PAS only 6 cases out of 37 showed regress, as the other ten had received streptomycin.

Where the patients were resistant to Sm., and one other drug they received at least one drug to which their bacilli were sensitive, i.e. INH or PAS. In this group 6 out of 15 cases (40%) showed regress.

In another group of cases where bacilli were resistant to Sm. but received PAS and INH all the 5 cases regressed. One case who received S + H did not deteriorate.

Again in cases which were resistant to INH only, 2 cases out of 6 regressed and one deteriorated. The case that showed progression of disease is rather interesting. He received PAS and INH showed regress at the end of three months but showed progress at the end of 6 months, when continued on the same drug regime. By that time he had developed resistance to PAS also. Similarly, of 68 cases resistant to PAS only, when observed on P + H treatment, 36 cases showed regress as against 8 cases showing deterioration.

The inference is obvious that about 41% of newly diagnosed and previously untreated cases were infected with drug resistant bacilli, presumably by index cases who were themselves resistant.

The fact that 17 cases were infected with INH resistant strains belies the contention that INH resistant cases are non-infectious, or it is safe to use INH alone on a large scale. This fact has to be emphasized because the so called International Experts are very keen to recommend use of Isoniazid alone for under-developed countries like Pakistan. I should say, it is here in the under-developed countries that the idea of using Isoniazid alone should be resisted firmly. What is not good for advanced countries is certainly no better for the under-developed countries, especially when these countries cannot afford the cost of minor drugs when cases become INH. resistant. Use of Isoniazid alone may solve some problems such as cost involved and administrative difficulties but it creates worse problems of drugs resistance. It is an interesting fact that cost of drugs forms only about 30% of expenditure of a chest clinic.

Use of a single drug is, therefore, not likely to effect enough saving as to offset disadvantages of the use of single drug.

It has also been shown that the response to treatment depends on sensitivity status of the cases at the time of initiation of treatment. When a drug is used in combination with resistant drug, it is like using a single drug, because resistance soon develops against the effective drug also.

In previously treated cases the cause of drug resistance has obviously been inadequate drug regime. Review has been made previously of commonest causes of treatment failure (Ross and Others¹ and Yad¹⁰). The commonest causes observed in my cases were :—

- (i) interrupted treatment mostly by patient due to ignorance or economic reasons : sometimes on account of "COURSES" of treatment prescribed by treating physician,
- (ii) Use of single drug, either on prescription or by defaulting one drug in a combination, (the most

common drug thus defaulted is PAS).

(iii) Inadequate dosage and duration.

It will be observed that drug resistance level in our country or at least in Karachi has reached alarming proportions and that it is on the rise. In a previous small study by MOSSIGE¹¹ in 1956, on the sputa tested for sensitivity against Streptomycin during 1955-56, he found that all the 32 cases who had not received any Streptomycin before registration were sensitive to Streptomycin. In the space of 5 years the streptomycin resistance in previously untreated cases has arisen from 0% of all positive sputa to 10.3%. In a still developing country neither the patients nor the community can afford treatment by minor drugs. The cheapest combination of minor drugs costs about 8 to 10 rupees per day as against Rs. 0.35 for PAS and INH i.e. about 30 times as much. It is imperative that every endeavour should be made to keep the drug resistance level at the minimum. Wherever possible the drug resistant cases should be isolated in a hospital. Due to shortage of hospital beds

most of our patients will continue be looked after on an ambulatory basis by Tuberculosis Clinics, general practitioners or private specialists. For proper supervision of cases on Chemotherapy every Tuberculosis Clinic should extend adequate domiciliary supervision to the patients by means of health visitors.

The principles of treatment of tuberculosis by specific drugs are simple and can be easily applied with due care. These principles should be well impressed on the undergraduates and every member of the profession should receive a copy of "Ten Rules of Chemotherapy" issued by Turkish Tuberculosis Association¹² wherein these principles are laid down in terse, but easy to understand style.

The sensitivity test is a must for judicious use of chemotherapy. The technique is simple and can be adopted in most laboratories and Laboratory technicians can be trained in this procedure. Most of the equipment is now manufactured locally and fresh media can be prepared quite cheaply in any Laboratory. There is no reason why these facilities should not be available to every patient.

Previously untreated cases should receive a combination of 2 drugs, one of which should be INH. But every case with previous history of treatment or contact with another treated case should receive all the three drugs in proper dosage until sensitivity report is available. Where doubt exists, it is better to use all the three drugs. As the results of this study were rather startling, the policy in the Centre was changed. At present every newly diagnosed case is prescribed all the three drugs, i.e. Sm., INH., and PAS. initially. The chemotherapy is then adjusted in accordance with the report of sensitivity test.

This is only a preliminary report. A further and more detailed report will be presented at a later date when a larger series of resistant cases is available for analysis. Large absenteeism renders smaller figures unsuitable for statistical analysis. Attention will also be paid to detailed study of the resistant strains.

I am indebted to Dr. S. Muhammad Sabih-ud-Din for collection of data and M/s. Pfizer-Dumex of Karachi, for the free supply of INH and PAS. for incorporation in the media.

SUMMARY

Chemotherapy has revolutionized management and prevention of tuberculosis. Unfortunately drug resistant bacilli frequently pose problems leading to treatment failure. For proper planning of Chemotherapy, drug sensitivity studies are essential.

This paper presents preliminary report based on the routine examination of sputum specimens of 4975 cases registered from March to November, 1961. Of 1035 cases found to be sputum positive, 434 showed drug resistant bacilli. The drug resistant level in previously untreated cases in Karachi is 41% which compares with 5.1% of Great Britain, 6% of East Africa and 12% of Nigeria. Drug resistance is on the rise in Karachi. Resistance to Streptomycin has risen in 5 years from 0 to 10.3%.

An analysis of response of drug resistant cases to routine treatment with PAS and INH showed that resistance plays a significant part in the prognosis of the case.

A plea has been made for judicious use of Chemotherapy and expanding facilities for sensitivity tests.

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FLEA INDEX STUDIES IN LAHORE

By

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HISTORICAL

According to the consensus of opinion, Asiatic Plateau is the original home of the Black Death and Central Africa is a colony of Asiatic plague.

The first authenticated record available is of an outbreak of plague Epidemic among the Philistines in B. C. 1320.

Rufus (Physicians at Ephesos, A. D. 100) traced the occurrence of Plague in Libya, Egypt and Syria as far back as the end of B. C. 300.

Another reliable reference is of the Pandemic, which commenced in the 15th year of Justenian's reign (A. D. 542). It originated in Pelusian (Lower Egypt) and spread far and wide to the ends of Inhabitable world. It ravaged for about 50—60 ears (590—600 A. D.) and took a heavy toll of 100 million persons.

PLAGUE IN INDO-PAKISTAN SUB-CONTINENT

Indo-Pakistan sub-continent does not present a promising field to study the history of plague. Unlike other countries viz., Europe, Egypt and China, historical evidence can hardly be said to exist in this country. The Sanskrit Literature provides most unsatisfactory historio-epidemiological and philological material. Vague descriptions of pests and pestilence, which depopulated towns in vedic period, does not permit even a very liberal worker to pin down plague as a cause. Superstitious beliefs, which influenced old scriptures, terribly camouflage facts. Ancient annals and classicals do not tell us of any disease which by any stretch of imagination may be said to resemble plague. Most of these chronicles dispose of social and

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moral upheavals and contagious depredations to three factors viz., "punishments from heavens, wrath of the gods and goddesses and astrological constellations." Individual diseases, as well as epidemics involving masses, were traditionally considered to arise from within an individual or a community due to their agnostic and skeptical deeds. In the absence of an authenticated data on the origin and real nature of plague in this sub-continent it may therefore, be folly to be wise. It would suffice to say that until the appearance of old sacred Hindoo book *Bhagwat Purana*, which adduces evidence to the presence of plague both in rodents and men of this Land of dieties, every thing alternated with gods and demons.

As stated before the Pelusians pandemic (A. D. 542) did not remain restricted to Europe and near East but was also rampant in Indo-Pakistan sub-continent to the South and China to the East as well as near Orient to the West. According to this record, plague did occur in this country long before the 11th century. It lends support to *Bhagwat Purana*, the legendary work, exercising more powerful influence than any other Purana in this country. This writing belongs

to the period between 400 and 1100 A. D. Here we have to remain contented with the ambiguity and absolute unreliability of the dates.

The next undoubted traces of plague, we may probably find from a historical review of invasions from the North-West. The pestilence undoubtedly came down to us in a somewhat circuit manner. Where as, one strain invaded from Asiatic Plateau the other crept in from Central Africa. Although the European strain had also fair chances to come, yet we have no evidence in hand to substantiate the conjecture.

No one, who surveys through the pages of the history, can fail to be struck with the fact that solely to exploit this country, nations after nations invaded the sub-continent from time to time. It is within the bounds of possibility to imagine, that plague infections could periodically be brought in, even in circuit manner, by these invaders. The arguments if accepted, may take the history of plague in this country far enough back. The following chronological review of the events, together with the position of plague in the original country of the invaders, is given below for ready reckoning.

Historical Event.

1. The history of the sub-continent begins more than 3,000 years before Christ, when Aryans migrated from Central and South-Eastern Asia and set in perpetual strife with Dravidians. Aryans entered Panjab by the valley of Kabul. The historical age however, begins in 600 B. C.

2. Alexander the great established the contacts of this sub-continent with the West in 327 B.C. From the 6th century B.C. to the 6th century A.D., Persians, Macedonians, Indo-Scythians, Perthians and White Huns had poured into the sub-continent through Northern passes. The Scythians in the time of Archæmicians emmigrated from Central Asian Steppes and founded a Kingdom in Western portion of

Plague Position

Migration of the people from plague stricken areas has always remained within the realm of human instinct. During the period of Aryan's migration, the quarantine laws did not exist (Quarantine laws were passed in 1374). Antiepidemic action was also unknown. This was the period when passage of the invaders through effected regions was not preventable (Land cordones followed in 1403), To our mind, the plague epidemic of 1320 B.C., which was rampant in Asiatic Plague, was most probably brought to this land by Aryans who continued coming until the 15th century A.D, waging incessant and bitter struggle with aboriginals.

Plague extended to North Persia on the shores of Caspian Sea in 1877. Plague epidemics of Cutch, Gujerat and Kathiawar in 1812—21, of Gharwal and Kummaon hills in 1823 and Poli (Rajputana) in 1836-38 are already known to be of Persian origin.

the Punjab. They were nomades and marched in through Baluchistan in 25 B.C. The Tokharis were a power in Central Asia and North-West of India for more than five centuries from 130 B.C.

3. Arabs started coming to the Indo-Pakistan sub-continent from 636 A.D. by way of sea and later through Mekran and Baluchistan passes in 712 A.D.

4. The Indo-Pakistan sub-continent was completely free from foreign invasion during the 7th century and 12th century. It was the period when the muslims were engaged in subjugation of Spain in the West.

5. Malabar coast remained famous for sea-borne trade with Arabia (Moors) and Persian gulf for considerably long time.

Turkish slave rulers, Mahmud Ghaznavi, Ghoris, Khilgis, Tughlaks, Lodhis, Mongols and Pathans subjugated the country to constant warfare for several centuries. Moghals appeared for the last time and established a permanent muslim rule here in the 16th century. Those countless, hordes of different stocks found their way in the country through North-West passes.

Mountaineous area of Assyr, situated in the border regions of the present day Yamen and Saudi-Arabia was endemic focus of long standing.

Bhagwat Purana was written between 400 and 1100 A.D. It adduces evidence to the presence of plague both in rodents and man during this period in this sub-continent.

Hirsch has stated that the pest left its strong-hold in Turkey in 1841.

6. Our North-Frontier border lies across the greater trade routes. The Afghans are intenterant dealers who even today ply their trade all over the northern parts of the country during winter through the North-West passes. Baluchistan region had direct communication with Persia and Central Asia. Sometimes immense bulk of the population of these regions continue drifting to North India.

7. Immigrants from West Indies, Fiji, and Natal has also been pouring in. Considerable exodus from Eastern submontane districts also remained a conspicuous feature of Indian history.

Chinese came to India before 224 B. C. After the advent of Buddhism (Budha died in 543 B. C. or 477 or 370 B.C.) the Chinese pilgrims periodically visited the country.

Until the spring of 1906 the former Province of N.-W. F. P. remained free from plague, except for a few imported cases, when it appeared in a virulent form, but its ravages remained confined to a small area of plains portion of Hazara. The Trans-Indus districts and agencies remained free altogether. An inspection camp established on the railways in 1896 prevented the spread of plague in upper Baluchistan. An out-break occurred in 1902 at Sonmiani in Lasbela.

The Imperial encyclopaedia, published in Peking, traces plague in China from 224 B.C. to 1718 A.D. Plague ravaged throughout Chinese Empire until 1345. In 1345 it spread to other parts of Asia and depopulated a greater part of Europe. The shipping traffic and land routes may have brought pestilence to the sub-continent intermittently. It appears that chroniclers did not care to record the fact.

In 1894 an outbreak appears to have originated in the interior of China. In 1895 Hong Kong was effected. In 1896 extension to India occurred and thence it spread to every corner of the globe.

8. The Europe of the 15th century did not know of Indo-Pakistan sub-continent. From the time of Alexander (327 B. C.) to that of Vasco-da-Gama, Europe had little direct intercourse with the East in general. Vasco-da-Gama discovered the sea route, via Good Hope, in May 1498. Another Portuguese emissary reached Calicut via land in 1487. For exactly a century, the Portuguese enjoyed the monopoly of oriental trade.

9. Dutch broke the monopoly of Portuguese in 1596. They attempted to find their way to the subcontinent by sailing round the northern coast of Europe and Asia. In 1658, they captured Jaffnapattam (Ceylon) and established a factory at Pulicat in 1609 and Surat in 1616. In 1664 they possessed factories at Masulipattam and other places in Coromandel coast at Hoogly, Cosimbazar, Patna and Dacca in Bengal and Surat, Ahmadabad and Agra in Northern India and besides seven stations in Malabar.

Plague out-breaks were recorded since 1908 in several Azores Islands.

Countless hordes of different Western stocks came to this country during those times when plague held a permanent sway over Europe. The country remained a shuttle cock of European diplomacy for two and half century. To augment their economic strength and enhance their political prestige, the Western powers continued stirring vigorously the tranquility of peace-loving people of this country. Ultimately the British emerged winners in the long contest.

10. French were comparatively late to arrive. The first French factory was found in Surat in 1668. They did not get steady support at home and therefore, failed terribly in this country.

11. The earliest English attempts to reach Indian sub-continent, were made by North-West Passages. The foundation of Russian Company for carrying on the over-land trade with India through Persia, Bokhara and Moscow was laid in 1553.

12. Thomas Stephens reached Indian peninsula in 1579. In 1583 India had four english merchants, as mercantile adventurers. In 1599 during the reign of queen Elizabeth I, John Mildenhall, travelled overland and spent seven yrs in this country. First landing on the coast of India was however, made in 1608. This was the time when English company established on the main land of India. Sir Thomas Roe did much to place the English trade in the Mughal dominions. Here after, English tenaciously maintained their hold upon the Indian seaboard. The trade and influence of the East India Company was not only pros-

Last epidemic of plague in France occurred in 1668. Fresh plague epidemic again occurred in 1720 and remained in the country until 1722. It was introduced from Syria via Marseilles.

Historical plague epidemic in England occurred in 1665. Cases in Glasgow occurred in 1900. An out-break was recorded in Suffolk in 1910.

1666 was the last year of the appearance of plague in England. Last case in Netherland also occurred in 1666 while in Italy and Spain it occurred in 1657 and 1681 respectively. Plague outbreak in Bari province and Messina were however recorded in 1691 and 1743.

perously maintained but also became steadily favourable. In August 1690 Job Charnock definitely founded the Capital of British India.

13. The Danes founded settlements of Tranquebar in 1620 and that of Serampore in 1676. All the Danish settlements were acquired by purchase for the British Government in 1845.

14. German, whether Prussian or Austrian, attempted to secure a share of the Indian trade during 1722-1784 but failed miserably to secure it.

AVAILABLE RECORDS :

According to Simpson (1905) plague epidemics did occur in the sub-continent from the 11th to about 17th century.

The evidence of pandemic appearance of plague in Indo-Pakistan sub-continent relates to 14 century A. D. from Central Asia.

Abul Fadl, in his autobiography at the end of Aeen-i-Akbari (III),

The last plague case in Denmark occurred in 1654. Elsinore and Copenhagen however, had it again in 1707 and 1714.

Last plague epidemic in Eastern and South-Eastern Germany occurred in 1681. The disease extended into Silesia, Prussia, and Pomerania from Russia and from these places to Holstein and Brunswick in 1707—14 and from Prague in 1713 visiting Austria, Styria and South-East Bavaria. (WuLien-Teh et al 1936—p.5).

states that in the city of Nager, between 1513 to 1522 A.D., a severe epidemic of plague broke out and the members of his father's family, except his mother, perished. Elsewhere in this book, he states that in the first year of Akbar's accession (1556 A.D.) to the throne, an epidemic of plague swept over the country and took a heavy toll of life and every one ran for one's life.

It spread to the sub-continent during the reign of Emperor Jehangir also in 1662. The disease later on declined to appear again in 1812—21. This time it was the Persian strain imported through Cutch, Gujerat Kathiawar.

The second authenticated outbreak occurred between 1836—38 (in Pali-Rajputana).

Besides isolated outbreaks, an endemic focus was known to exist in the southern slopes of the lofty Himalayas in the province of Kumaon and Garhwal.

It will not be out of place to mention that *Mahamani*, a disease identical to plague, has long been known in Kumaon and became several times an epidemic.

The North-West Frontier region of West Pakistan lies across the greater trade routes, which contact trans-border tribal territories and marts of Afghanistan and Central Asia. Until 1906, this part of the country remained free from plague except a few imported cases. The pestilence occurred in virulent form in small areas of the plains of Hazara district. Trans-indus districts and agencies however, remained free altogether till 1908.

HISTORY OF PLAGUE IN LAHORE

Lahore Town—Although the popular legend attributes founding of Lahore or Lahawarna to Lava, the son of Rama, yet the first authenticated record of this great town is that of Hiuen Tsiang, who visited it in 630 A.D, on his way to Jullunder.

Lahore is the capital of West Pakistan. It is situated in $31^{\circ} 35'N$ and $74^{\circ} 20'E$, on the left side of the river Ravi. It is 784 miles due East of Karachi. The district is bound by the districts of Sialkot and Amritsar on the North-East, by Sheikhpura on the North-West end by Montgomery on the South-West. Its upland portion is irrigated by the Upper Bari Doab Canal.

Lahore is the second largest city in West Pakistan. Its population was 1,297,000 in 1961, amounting to 10,133 persons to a square mile and forming 3.03 per cent of the population of the province.

Lahore remained a flourishing commercial centre since very long time. Its direct trade connections with Bombay, Calcutta, Delhi,

Karachi and Peshawar both by rail and road were established in early days. The famous Grand Trunk road passes through Lahore. Another important metalled road runs from Lahore to Ferozepur. In addition, metalled roads also connect it with Multan and Lyallpur districts. Besides these, there is also a net work of metalled and un-metalled roads connecting the capital with other important towns of the district. A number of ferries on the rivers Sutlej and Ravi are also source of trade connections.

The native city covers an area of about one square mile. It stands on the debris of ages. A metalled road runs round the outer side of the rampart and gives access to the city by the thirteen gates. Within the city, narrow and tortuous streets as well as lanes, some of them ending in *culs-de-sac* and lined by tall houses, give native Lahore a gloomy appearance. The portion of the city outside the walls, once consisted of numerous thickly inhabited suburbs, is now connected by long bazars. The vast land, lying between the native walled city and old civil station,

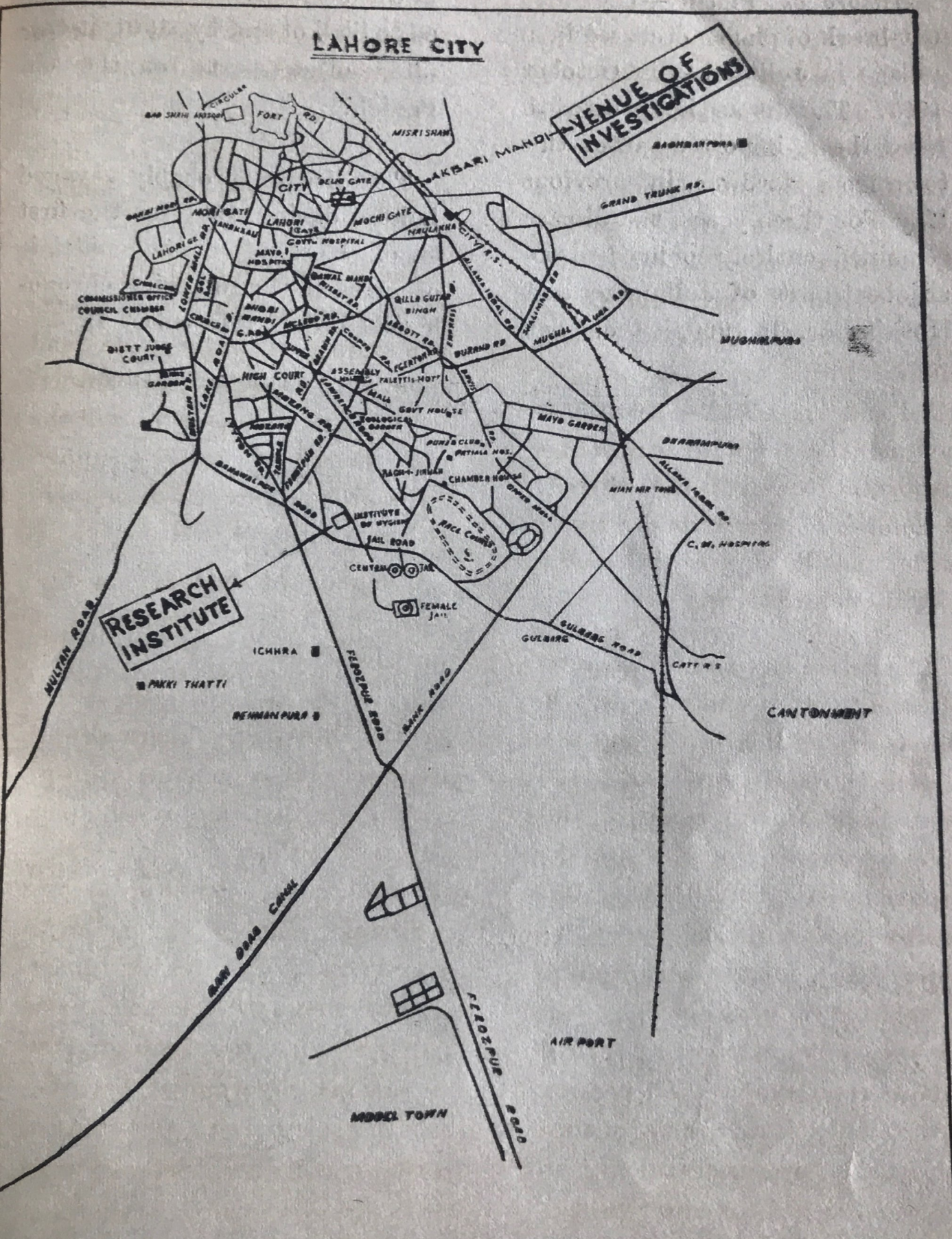
is now occupied by new modern and ultra modern buildings.

Lahore of today is renovated capital and one finds, fresh additions of ultramodern houses every year.

The water supply of the city is drawn by wells. Each area has its own system of water works and reservoirs. In some areas however, the hand pumps are still the only source of water supply. Wells (*bowlis*) are also common with-in the native walled city.

A depleted drainage system exists and is being remodelled in some localities.

Lahore is an important centre for the collection of agricultural produce. Its commercial prosperity is steadily improving since partition. Cottage industries, factories, mills, printing presses and banks employ the majority of its population. As headquarters of the province, Lahore naturally contains the head quarters of various government departments. Principal educational institutions, and chief medical institutes are its main attractions. Lahore in the language of Abul Faizi is "*the grand resort of people of all Nations*"



Map of Lahore City.

History of Plague.—The first out-break of plague occurred in a village in Jullundher in October 1897. The disease is reported to have been imported into this town from Hardwar in previous May. For three years, the disease remained entirely confined to the adjacent parts of Jullundher and Hoshiarpur. In 1900, it broke out

in Gurdaspur and soon after spread to Sialkot and by 1901 it engulfed other parts of the old Panjab.

The disease probably revaged Lahore during 1901 for the first time. Here after the epidemic occurred in the following chronological order (Statement I).

STATEMENT I GIVING TOTAL NUMBER OF DEATHS, DUE TO PLAGUE IN LAHORE DISTRICT FOR THIRTY-SIX YEARS FROM 1901 TO 1936

	1901-1908	1909-1918	1919-1928	1929-1936
..	..	2458	1611	Nil.
..	..	12080	8	Nil.
180	180	2527	2	2
11814	11814	69	29	1
23698	23698	61	517	1
25734	25734	265	21121	75
28787	28787	9259	1680	2
10614	10614	54	6267	1
47421	47421	2056	306	..
3508	3508	24971	592	..
Total for the period ..	151,747	52,900	32,132	82
Annual average ..	18,969	5,290	3,213	10
Percentage of the total ..	69.013	19.246	11.689	00.052
Grand total for 36 years..	236,861	Annual average for 36 years		6,579.5

July, 1963

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The last case of plague in Lahore town occurred in May or July 1936. Another case about this period was recorded from the Lahore district. Since July 1936, no case of plague is said to have occurred in the town or district of Lahore.

From the statement I, given above, it will be seen that from 1901 to 1928 no single year has passed without a plague case in the history of Lahore. During 1912—14, 1916, 1920—23, 1927 and 1928, the pestilence continued smouldering in different parts of the district. Save a very limited epidemic in 1934, the town remained either free from plague or the disease made extremely little progress after 1928 and it never succeeded to become endemic in this area. Unlike other towns, the pestilence seems to have struck temporary terror in the heart of Lahorites. Whereas in the west "*Let a plague be fall you.*" is a common phrase showing terror stricken phase of the human mind, in this part on the other hand man behind the plough always says "*let a hailstorm befall you, or let your canoe sink*"* to the man whom he wants to curse. It indicate that in medieval days, plague did not

threaten this region to the extent as to warrant a phrase of fear.

PLAGUE FOCI

According to Sharif (1951), there are three independent plague foci in India. West Pakistan is threatened by the sub-Himalayan foci, which consists of three separate foci, occasionally behaving independent of each other. One of these foci, continued causing outbreaks in East Punjab Utter Pradesh and district. of Bihar, North of Ganges. According to some authors, the epidemic of 18th century originated from this foci.

The sub-Himalayan foci is definitely of very long standing. The endemicity for instance was known to exist in Garhwal and Kumaon Hills in 1823. To our mind, the endemicity in this region is probably of still much older standing and is a relic of great pestilence of seventeenth century or still before.

The general trend of endemicity of the disease has been discussed in Bhore Report (Vol. I). Kaul (1949) also gave a vivid picture of the pestilence in Indo-Pakistan sub-continent since its introduction in 1898 from Hong Kong via Bombay.

*Gara Pawe, Rur jawen, Bera dubbe, etc.

STATEMENT II GIVING SEVERITY TREND OF PLAGUE IN INDO-PAKISTAN SUB-CONTINENT DURING DIFFERENT PERIODS (FROM 1898 TO 1948).

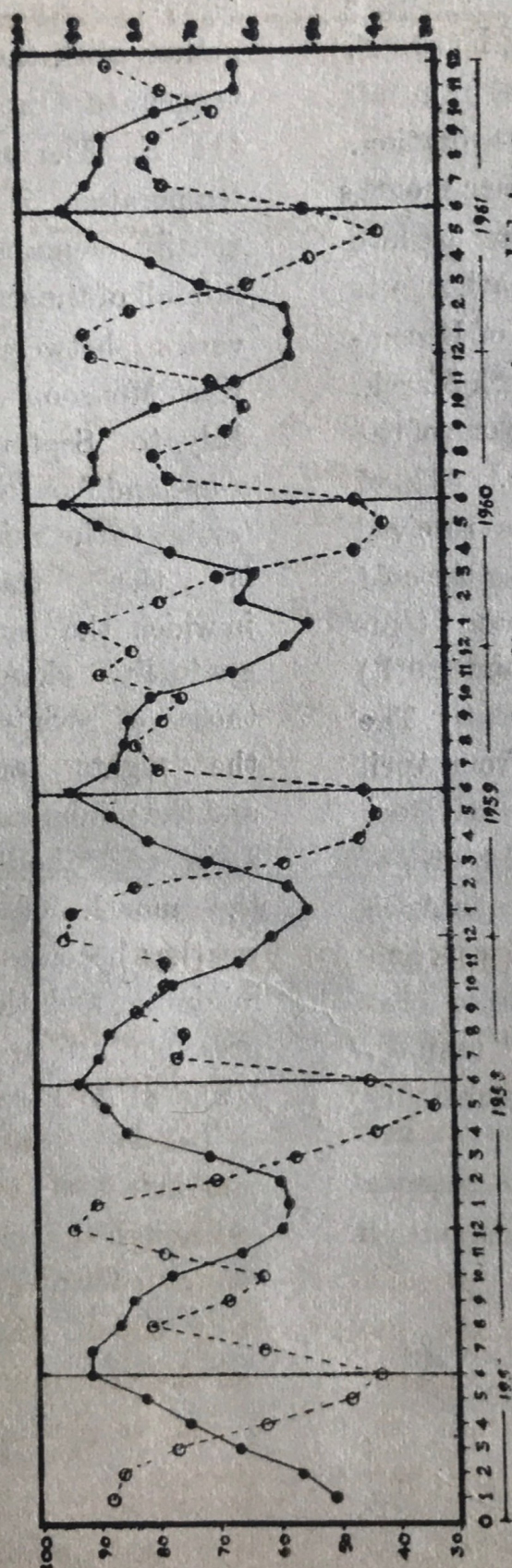
Period	Total Deaths	Annual average	Death in each period expressed as Percentage of the Total (1898-1948)
1. 1898-1908	6,032,693	538,427	47.88
2. 1909-1918	4,221,528	422,153	33.51
3. 1919-1928	1,702,718	170,272	13.32
4. 1929-1938	422,880	42,288	3.36
5. 1939-1948	217,970	21,797	1.73
1898-1948	12,597,789	297,015	100

CLIMATE OF LAHORE

Meteorological conditions have a very large influence on the duration of the life, both of the reservoir host and its flea infestation. Seasonal fluctuation in their incidence is also subordinate to the periodic climatic changes. Climate has also definite influence on plague epidemics. Whereas certain climatic conditions help in the flare

up, another just allows its smouldering.

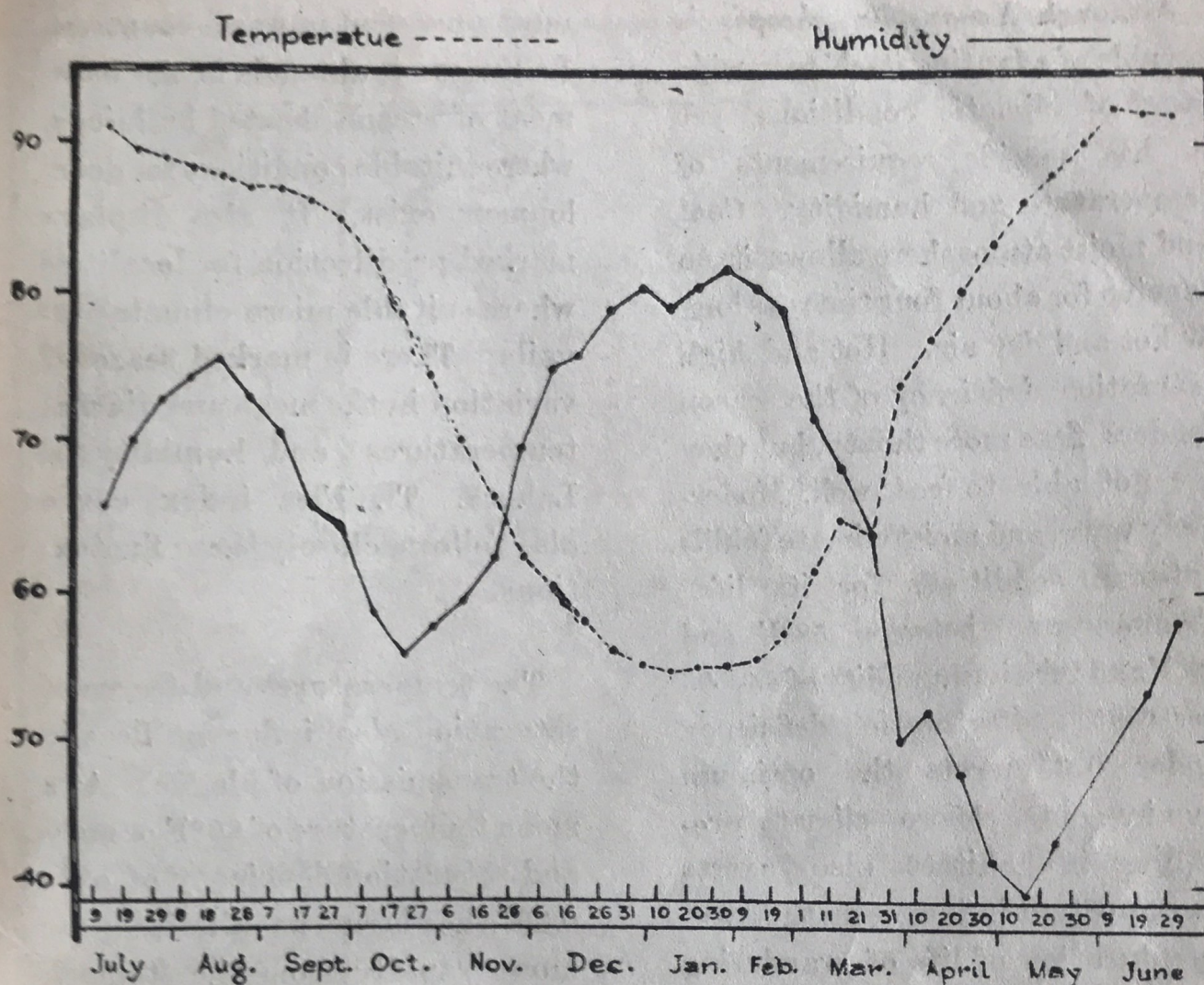
Lahore shares the climatic characters of Lucknow in India. Although this climate is not very suitable for plague as that of Western Ghats, where plague existed all the year round, yet it is congenial to produce repeated epidemics.



Graph I showing the relation of humidity (broken line) mean temperature (solid line) in Lahore during 1957 to 1961.

The average annual temperature of Lahore varies from 60°F to 70°F . The monthly and annual rain fall is always less than evaporation. The temperature in summer months may go upto 117°F . There are late summer rains. Cold weather sets in Lahore by the middle of December. It continues through March. The winter rainfall is also one of the characteristics of Lahore. 33% of the total annual rains is received during this season. During the cold wave period, a minimum temperature below freezing point (29°F) and frost may occur frequently. The hot weather commences from April and continues through June. Dust raising winds are special features of this weather. Cold waves in April are sometimes associated with hail storms. As the hot season progresses, the highest day temperature steadily continues increasing

and remains unabated for days together with the mean maximum temperature ranging from 105°F to 115°F . The mean daily range of temperature is 80° — 100°F . It usually remains dry. The total rainfall of the season (April—June) varies between 1'—3". South-West Monsoon establishes during July to September. Heat subsides, and from the middle of September to the middle of November is the transitory period, in which the monsoons continue gradually changing over to those of winter. In October, the nights are fairly cool and the minimum temperature remains near about 55° — 60°F . In the month of November, the weather becomes pleasant as the minimum and the maximum temperature are in the range of 55°F and 81.5°F respectively.



Graph II showing the relation of humidity and mean temperature in Lahore
 Jour. Hyg., Cambridge (Plague Suppl.) ; 1915 : 708

The freedom from or susceptibility to plague of a place depends rather on a combination, in varying degrees of some or all features such as the climate, the number of people and their habits, agriculture, trade, the number and immunity of its rats to plague and the number of fleas found on them. Length of life of rat fleas, when separated

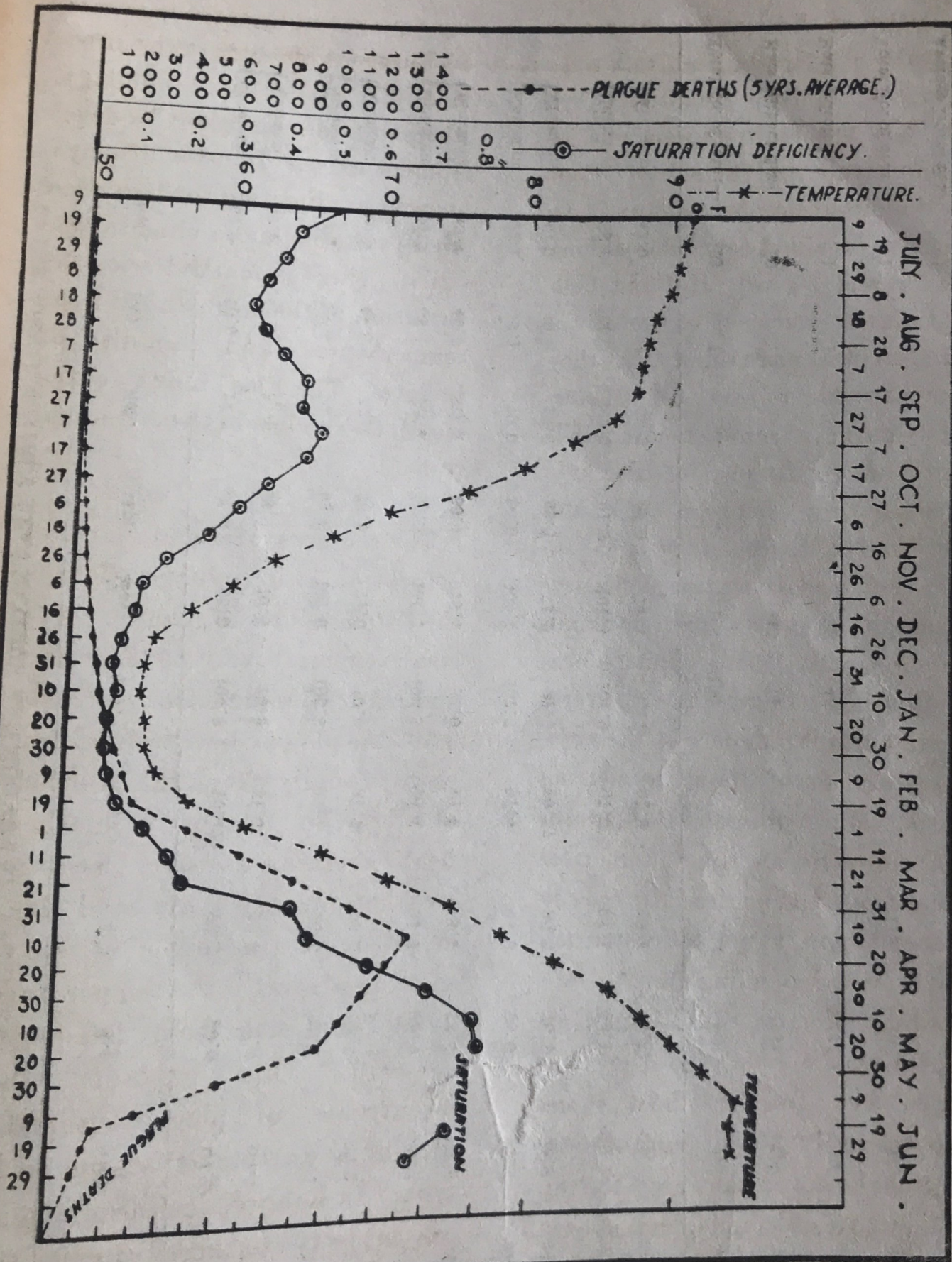
from their hosts, also plays an important role in plague transmission.

The combination of temperature and humidity factors influence the biology of the fleas. The flea density also oscillates according to the power of tolerance and endurance of the species.

Although *Xenopsylla cheopis* is capable of adapting itself to a wide range of climatic conditions, yet it has specific requirements of temperature and humidity. Cool and moist atmosphere allows it to survive for about four times as long as hot and dry air. Hot and high saturation deficiency of the season renders fleas more thirsty, but they are not able to feed well. Moderately warm and moist climate fulfills optimum conditions for its life. Temperatures between 58°F and 68°F and relative humidity of 85—95 per cent. and saturation deficiency under 0.3" meets the optimum requirements. Micro-climate prevailing in habitats also exerts an important influence on the average duration of life of wandering fleas. Micro-climate also imposes an embargo on their numerical variation. Although adults mostly depend upon their host for nourishment, yet, depending upon the prevailing climatic conditions, time spent on the host and the time spent away from the host varies considerably. Under suitable conditions however, they have the tendency to lead an independent existence as 'free living insects.' Fleas generally feed frequently. *X. cheopis* is a "warmth loving" flea and is

most prevalent in warm countries. In Europe it abounds in the basement of steam—heated buildings, where suitable conditions for development exist. It also displays marked predilection for localities where suitable micro-climate prevails. There is marked seasonal variation in the mean and diurnal temperatures and humidity of Lahore. The Flea index curve also follows closely these fluctuations.

The temperatures and degree of saturation also influence fleas in the transmission of plague. At a mean temperature of 80°F or more and saturation deficiency of over 0.30" the plague bacilli disappear more rapidly from the stomach of a flea. The life span of blocked fleas shortens as soon as the weather becomes hot and dry. *X. cheopis* is incapable of transmitting plague, if the temperature is 68°F and saturation deficiency is 0.6". This explains the occurrence of plague outbreaks during a particular season of a year. In Lahore, decline of plague cases always occurred during the height of hot seasons, when the mean atmospheric temperature and saturation deficiency was



Graph : III showing the influence of Saturation deficiency and of temperature on the course of epidemic plague in Lahore.
(Jour. Hyg., Cambridge (Plague Suppl.) : 1917 : 884)

TABLE : I

SHOWING THE NORMAL MONTHLY MEAN MAXIMUM AND MINIMUM TEMPERATURES (°F) IN LAHORE FOR

1957-1961

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
1957	Maximum	62.9	70.0	78.7	87.9	96.6	104.8	101.7	93.7	96.3	91.9	78.7	67.9
	Minimum	43.1	42.8	55.0	63.8	70.8	78.2	81.5	78.8	72.5	63.1	52.9	46.0
1958	Maximum	70.4	73.9	84.5	99.6	102.6	106.8	97.7	96.5	90.2	89.1	80.1	69.4
	Minimum	56.3	45.6	57.7	70.0	74.6	79.6	81.7	70.3	75.7	65.1	51.1	46.9
1959	Maximum	65.2	68.4	83.9	95.5	101.7	108.3	96.4	94.4	93.4	92.0	77.4	71.5
	Minimum	43.4	46.5	57.5	66.4	73.4	82.0	80.4	79.4	78.4	68.3	54.0	42.9
1960	Maximum	66.1	79.1	79.0	90.5	104.4	107.7	97.4	97.3	98.6	83.8	81.8	71.8
	Minimum	40.0	49.8	55.6	63.3	73.2	81.3	80.77	80.3	76.8	62.8	48.8	39.7
1961	Maximum	68.0	66.7	82.5	91.5	101.8	104.9	97.5	94.1	94.1	90.1	76.8	67.7
	Minimum	43.0	45.2	56.3	65.9	74.3	82.7	81.3	80.1	78.8	64.3	49.2	29.7
Total No. of rats:—	23	1	..	..	138	120	36	208	289	218	202	120	
Rats without fleas	22	..	..	..	115	74	33	166	243	122	180	119	
Rats infected ..	1	1	..	..	23	46	3	42	46	96	22	1	
Total No. of fleas	1	1	..	..	63	56	7	115	102	280	47	3	
Average No. of fleas per infected rat.	1	1	..	..	3	1	2	3	2	3	2	3	

TABLE : II
SHOWING THE NORMAL MONTHLY MEAN RELATIVE HUMIDITY (%) AND RAIN FALL (INCHES) IN LAHORE FOR
1957-1961

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
1957	Rel. Hum.	88	86	77	62	48	43	62	81	68	62	79	94
	Rainfall	3.73	0.24	2.50	1.58	0.64	0.41	4.54	10.84	0.44	0.18	0.37	1.47
1958	Rel. Hum.	90	70	57	43	33	44	76	75	83	78	78	95
	Rainfall	0.35	0.00	0.33	0.14	0.08	2.13	5.93	2.46	19.41	0.43	0.16	2.81
1959	Rel. Hum.	94	81	58	45	42	44	79	83	78	75	89	83
	Rainfall	2.15	0.62	0.56	0.01	0.51	0.23	8.13	11.49	1.75	0.42	11.4	0.00
1960	Rel. Hum.	91	78	68	45	36	45	76	79	66	63	69	85
	Rainfall	1.05	0.00	1.82	0.63	0.00	0.78	2.67	2.86	2.11	0.00	0.00	0.40
1961	Rel. Hum.	90	82	62	52	40	53	76	79	77	67	76	85
	Rainfall	3.81	1.03	0.42	0.86	0.80	0.53	8.16	4.97	2.86	0.96	0.02	0.26

high. According to Hirst, maximum average number of *X. cheopis* per rat exceeds 12 during this season. High average temperature, even with high humidity, makes fleas sluggish. Plague transmission under these conditions is therefore, adversely affected. Plague epidemic reports of Lahore show that here plague season is well defined as compared to sub-tropical sea ports, where outbreaks are less explosive but persistent in character.

OBSERVATIONS ON THE RATS OF LAHORE

In the natural history of plague, the rodents form both reservoirs and hosts of infection. When human beings however, are involved in the chain, the rodents become reservoirs while the man becomes the host of infection.

For prevention, control and eradication of the disease, an ability to distinguish the reservoir host involved in a locality seems to be a pre-requisite. The role of various

domestic, peri-domestic, semi-domestic and wild rodents varies substantially from place to place. Systematic studies of rodents susceptible to plague are therefore, desirable.

Plague infection, on reaching a new place, has a murine phase before it is passed on to the wild rodents. Commensal rodents are principal agents in the perpetuation of plague in man. Epidemics in man are invariably preceded for 10—15 days by epizootics of black rats.

With a few local exceptions, the commensal rats belong to the murine species viz., *Rattus rattus*, *R. norvegicus* and *Mus musculus*. These three can be conveniently identified. *Bandicota*, *Gunomys* and *Nesokia* species may be cause of confusion and therefore should also be recognised as such. Plague infection of rodents other than murines viz., squirrels and non-rodents mammals i.e. bats, is of rare occurrence in this sub-continent.

Susceptible reservoirs

Commensal rats and mice.

1. *Rattus rattus* : (+).
2. *R. norvegicus* : (+ +).
3. *Mus musculus* : (less)

About seven murine species viz., *R. rattus* (*R. r. rufescens*, *R. r. concolor* and *R. r. alexandricus*), *R. norvegicus*, *Mus dubius*, *M. musculus*, *Gunomys bengalensis*, *G. varius* and *Bandicota malabaricus* have

Accidental Infections

1. Indian palm squirrel (*Fomambulus palmarum* : Karachi).
2. Porcupine (*Hydrochoerus* sp.)
3. Monkeys.
4. *Bandicota indica* (Large Bandicota).
5. *B. bengalensis* (Indian mole rat)—incriminated in plague outbreaks in Calcutta. *Bandicotes* play a role in the establishment and maintenance of sylvatic plague foci. These rodents are able to establish near human habitats and apt to act as intermediaries in the spread of plague and may take the place of less susceptible rat strains and therefore, may become dangerous.
6. *Cavia cobaya*.

been previously recorded from various regions liable to plague in Indo-Pakistan sub-continent. In N.-W. region of the subcontinent, *R. rattus* is by far the most important species involved in the transmission of

plague. Its numerical density, wide distribution and domestic habits are the main contributory factors in implicating this rodent in perpetuation of the infection. Progress in civilization, high standards of cleanliness, better housing system and improved sanitation have lowered rat incidence in houses and reduced chances of spread of the disease. Although plague has ceased to exist in Lahore since 1936, yet chances of an outbreak due to an importation of the infection in fleas from Sub-Himalayan endemic foci is even worst today than it was a quarter century before, when means of transportation were comparatively slow and inadequate.

Plague is notorious to entrench itself in rodent hosts and continue smouldering for a considerable time. The availability of fuel for the perpetuation and spread of the disease in a locality warrants constant vigilance. "No rats, no plague" is a popular slogan. This dictum dictates one, even a common man, to know the incidence of rats in the town of Lahore.

In order to define various commensal murines found in Lahore and their seasonal prevalence, we

carried out survey for full one year. For the purpose of these investigations, we originally selected three representative catching stations within Lahore. We did not get encouraging results from two stations, viz., Gulberg and Ichhra and therefore, abandoned observations from these sectors. The observations were, however, continued in Akbari Mandi.

Trapping Station—Akbari Mandi is in the heart of native town. It is an important centre of agricultural produce. There are large godown, of grains, where wheat, rice, cotton seed, oil seeds and their products are hoarded during harvest period. This area is located in the congested part of the city and is therefore, much behind the other localities in sanitation.

All the houses in the mandi were given serial numbers. Every day, except on Sundays and holidays, the traps were placed in a group of ten houses. These traps were collected next morning and another batch of ten traps was placed in the next group of ten houses. When the total houses were thus used, the cycle was again repeated in the same order.

July, 1963

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The trapped rats, were killed one by one and examined for fleas. Total number of fleas and the number of rats found positive were noted separately. The Table : III gives total number of rats trapped during each month. The Table V gives weekly figures of the rats examined, and the number of fleas found on the positive rats.

The development of our transport system has helped the spread of rats and their fleas as readily as it has helped the movement of man. As might be expected, incidence of different murine species varies considerably from place to place. During the period of 12 months under observations, 1410 rats of all kinds were brought to our Laboratory. Of this number, 52 (3.6 per cent) were mice (*Mus musculus*), 4 (0.3 per cent) were musk rats (*Crocidura sp.*) and the remainder (96.1 per cent) were all roof rats (*Rattus rattus*).

Rattus rattus is known to be very conservative in nature. It does not adapt well with the changing environments. This is probably

why it is not yet found in abundance in elite quarters of Gulberg. It was also previously observed that its greatest concentration occurs in most densely populated sections of the city.

Data available from other parts of Indo-Pakistan subcontinent also shows that *Rattus rattus* forms an overwhelming majority of rat population in the plains. From the figures before us, it is seen that rats were more or less absent in crowded quarters of the town during the months of February, March and April, and less numerous in the months of January and July. The population continue rising up from the month of May.

We do not suspect our rats infected with plague at present. Neither there seems any chances of plague infection in wild rodents, as there is so far no evidence available to show presence of sylvatic plague in this region. Plague among the wild rodents is known to cause isolated plague cases in persons crossing their way.

TABLE : III
SHOWING MONTHLY TREND OF RAT DISTRIBUTION WITH FLEAS FOR THE YEAR
1961

Month	Total No. of rats	Rats without fleas	RATS INFESTED		Total No. of fleas	Average No. of fleas per infested rat
			No.	Percentage		
January	23	22	1	4.4	1	1
February	1	..	1	100	1	1
March	..	..	..	..	..	..
April	..	..	..	..	..	..
May	138	115	23	16.6	63	3
June	120	74	46	39	56	1
July	36	33	3	9.1	7	2
August	208	166	42	20.2	115	3
September	289	243	46	15.9	102	2
October	218	122	96	44.0	280	3
November	202	180	22	12.2	47	2
December	120	119	1	2.5	3	3
Total	1355	1074	281	20.74	675	2
<i>Flea index</i> .. $675/1355=0.4981$.						

Greatest concentration of roof rat is known to occur in most densely populated sections of the city. It is why several months' efforts did not encourage us to continue work in Gulb-erg and Ichhra. A perusal of the table III shows the following striking features.

- (i) Out of 1355 commensal rats trapped, only 281 rats were infested with 675 fleas and the average number of fleas to a rat having the flea worked out to be $675 \div 281 = 2.0$. However, the average with respect of the total number of rats is nearly 0.51
- (ii) The population of commensal rats in domestic areas increases after the harvest season when food articles *i.e.* wheat, grain etc. are brought to the stores.
- (iii) The number of fleas collected from rats trapped during harvest period was greater than from those trapped during non-harvest period.

(iv) During the months of February, March and April the rats could not be trapped from the grain stores. Roof rat is less able to withstand cold environments, shortage of either food supplies or resting sites also limit the number of these rats. Probably these two factors may be accounted for their decrease during this period.

(v) Rats also appear to be less numerous during July, the month of torrential rains in Lahore.

RAT FLEAS IN LAHORE

The public health significance of fleas is now well appreciated. The role these loathsome, small, wingless, laterally compressed insects play in the spread of dreadful bubonic plague has been vividly demonstrated. Some of these blood thirsty, vaulting parasites, remain on the body of the host constantly while others do so only for the purpose of obtaining food. Between the two blood-meals, the fleas prefer to remain with in the

environments frequented by the host. Although certain species of fleas predominate on given species or group of host species, yet host-parasite relationship is not of strict nature. In addition to the favoured hosts, there are alternate hosts. This wide range of host-preference has increased their public health importance still more.

Bubonic plague infection is known to travel about from one country to the other for the most part in infected fleas, associated with merchandise such as grain or with the persons of human be-

ings. It is pertinent to remember that the likelihood of infection travelling any given distance is proportionate to the conditions favourable to the life of the rat flea in transit.

Fleas are commonly known as Siphonapteran insects. The fleas falling into the family Pulicidae are of great epidemiological interest. Craig (1921) has reported three species of fleas from old Panjab table IV. Other species recorded from plague stricken areas of India were however, not found in this region.

TABLE: IV

SHOWING COMPARATIVE PROPORTION OF SPECIES OF FLEAS IN VARIOUS REGIONS OF THE SUB-CONTINENT

	<i>Xenopsylla</i>			<i>Leptopsylla</i>	<i>Nosopsylla</i>		<i>Ctenocephalides</i>	
	<i>cheopis</i>	<i>astia</i>	<i>brasiliensis</i>	<i>musculi</i>	<i>punjabensis</i>	<i>nilgiriensis</i>	<i>felis</i>	<i>canis</i>
Punjab ..	55	42.8	..	..	2.1	..	..	..
Bombay ..	73	10.6	16.4	..	..	..	..	..
United Provinces	63.6	36.4	..	..	..	..	..	..
Central Provinces	25.7	2.1	72.2	..	..	..	..	..
Madras ..	43.1	47.3	6.2	1.5	..	1.9	..	..
Calcutta ..	26.8	73.1	..	..	..	..	Few	Few

During the period in which our observations were made, 675 fleas were collected from 281 rats. The over all number of rats examined was however, 1355. The average number of fleas on rats did not exceed 3. Of these fleas, with the exception of three cat fleas—*Ctenocephalides felis* (not included in the counts), all were *Xenopsylla cheopis*.

The Table : V shows, that there is marked seasonal prevalence of fleas. In the month of January the number per rat ranged from 0 to 1. After the second week of

May, the number of fleas steadily increased from 1 to 3 per rat. The highest percentage of rats infested with fleas was however, found in the second week of June, last week of August and september, first week of October and later half of October. On an average about 21 per cent of rats trapped were found infested with fleas. Steady fall in the percentages of infested rats was observed from 3rd week of November. Number of fleas found on rats, vary from 42—91 percent in the first half of the year, and from 51—63 percent in the 2nd half of the year.

TABLE : V

SHOWING WEEKLY DISTRIBUTION OF RATS AND FLEAS DURING THE YEAR 1961.

Dates	Total No. of rats	Rats without fleas	RATS INFESTED		Total number of fleas	Average number of fleas per infes- ted rat
			No.	Percent- age		
1st January to 8th January 1961	..	..	..	..	..	..
9th January to 15th January 1961	8	8	..	0%	..	..
16th January to 22nd January 1961	10	10	..	0%	..	..
23rd January to 29th January 1961	5	4	1	20%	1	1
30th January to 5th February 1961	1	..	1	100%	1	1
6th February to 14th May 1961	..	..	..	..	..	..

Dates	Total No. of Rats	Rats without Fleas	RATS INFESTED		Total number of fleas	Average number of fleas per infes- ted rat.
			No.	Percent- age.		
15th May to 21st May 1961	.. 18	14	4	22%	10	2.5
22nd May to 28th May 1961	.. 39	31	8	21%	12	1.5
29th May to 4th June 1961	.. 99	82	17	13%	50	3
5th June to 11th June 1961	.. 88	50	38	43%	43	1
12th June to 18th June 1961	.. ..	..	..	..	..	..
19th June to 25th June 1961	.. 14	12	2	14%	4	2
26th June to 23rd July 1961	.. ..	..	..	..	..	..
24th July to 30th July 1961	.. 34	31	3	9%	7	2
31st July to 6th August 1961	.. 55	43	12	22%	19	2
7th August to 13th August 1961	.. 39	32	7	18%	21	3
14th August to 20th August 1961	.. 69	56	13	19%	49	4
21st August to 27th August 1961	.. 13	5	8	61%	24	3
28th August to 3rd September 1961	.. 64	60	4	6%	4	1
4th September to 10th September 1961	70	68	2	3%	2	1
11th September to 17th September 1961	40	38	2	5%	2	1
18th September to 24th September 1961	71	61	10	14%	18	2
25th September to 1st October 1961	.. 78	48	30	40%	78	3
2nd October to 6th October 1961	.. 59	29	30	50%	84	3

9th October to 15th October 1961	46	36	10	20%	34	3
16th October to 22nd October 1961	55	26	29	53%	81	3
23rd October to 29th October 1961	49	26	23	47%	72	3
30th October to 5th November 1961	33	29	4	12%	9	2
6th November to 12th November 1961	45	40	5	11%	12	2
13th November to 19th November 1961	65	53	12	18.5%	27	2
20th November to 26th November 1961	43	42	1	2%	1	1
27th November to 3rd December 1961	35	31	4	11%	7	2
3rd December to 10th December 1961	21	21	..	0%	..	..
11th December to 17th December 1961	44	44	..	0%	..	..
18th December to 24th December 1961	36	35	1	2%	3	3
25th December to 31st December 1961	9	9	..	0%	..	..
Total	.. 1355	1074	281	20.74	675	2

The numerical density and the corresponding rat *flea index* of 0.47 calls for routine protection of the population, because, it is above recognised critical level of about 0.2. In this connection, we should not forget that climatic conditions have tremendous influence on these insects. Favourable conditions affect both the rate of development and survival

rate of the fleas. High saturation deficiency exerts an unfavourable influence on the wandering adults. The developing larvae are not resistant to dryness of the atmosphere. Excessive high humidity is also inimical for the development of the larvae. Micro-climate available in the burrows of the rats more or less remains suitable for the

and development of fleas. Extrinsic climatic conditions exert important influence upon the frequency of fleas on the host. According to Hirst, rainy weather lowers flea count in the hot weather while under dry climatic conditions the fleas feed more often and therefore, are found on the host for most of the time.

COMPTE RENDU

It would be easy to be clever.
And tell the stones: Men hate
to die.
And have stopped dying now
forever.
I think they will believe the lie.

—Robert Frost.

Although plague is not known at present in Lahore, yet the potentiality of the pestilence is so evident and great that a continuous watch is necessary in the inter epidemic periods to be able to prevent its outbreaks. In view of very long intervals between the epidemics, one cannot afford to neglect rat extermination and rat elimination measures.

Studies on flea population is an equally important measure in inter-epidemic periods. In fact, it is desirable that this should be a regular feature of all the local health departments. It is with this objective that this study was undertaken in a selected area of Lahore to determine *flea-index* and its seasonal fluctuations so that Municipal and District Health authorities may not only initiate such studies but may also make it a routine feature of their activities.

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A SURVEY OF GUINEA WORM DISEASE IN THE SIND DESERT (THARPARKAR DISTRICT) OF WEST PAKISTAN.

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Need and necessity breed culture, the natural environments shape it and make it specific to the area. The geographical factors radically influence the social, mental and economic development of communities inhabiting an area. Each community has its own disease pattern'. A certain disease is prevalent in a particular group of people only because it fits in well in the socio-cultural complex and ethnic traits of the community involved.

Dracontiasis still figures prominently in many parts of the world. Its presence is closely webbed with the geography and surroundings, cultural patterns, habits and customs, beliefs and attitudes of a community. Presence of dracontiasis may be taken as a yard

stick to the premitiveness of the culture, the socio-economic level and extent of health consciousness of the community. The prevalence of guinea worm disease in the continents of Africa and Asia is testimony to the presence of: backward or unprogressive people, areas of water scarcity, faulty water storage system and lack of communication with the outside World.

There are numerous scattered reports on the occurrence of guinea worm disease from various parts of West Pakistan. The localities in which this disease is prevalent have however, not been fully delineated. Sporadic cases of guinea worm have long been reported from the Indus basin. The disease is known to be endemic in Attock, Dera Ghazi Khan, Muzaffargarh and Mianwali

districts. Cases of guinea worm disease have also been observed in some districts of former North-Western Frontier Province, along the tribal belt, where the source of drinking water are ponds. In the former Province of Sind, Dracontiasis has been common in the Tharparkar district and appears to be restricted within the Sind desert.

The hospital and dispensary figures available to us seem to be unreliable because normally only a small number of the guinea worm cases come to these institutions for treatment. Surgery is awe inspiring and unacceptable to the backward people. People avoid hospital treatment despite the knowledge that the only course of treatment in complicated and advanced cases of Dracontiasis is available in hospitals alone. From hospital data it, is therefore, not possible to draw any reliable inference on the incidence and trends of this disease in an area. This evidence may merely serve as an authentic record on the existence of the disease in the region. A reference to Table, II and III will show general aversion of the people

to the hospital treatment. There was very high incidence of guinea worm disease in Taluka Chachro but the attendance of guinea worm cases at the hospital during the period of our survey was meagre.

It will also be interesting to note that the hospital and dispensary figures do not necessarily indicate the local cases alone. The data also includes cases from other areas. Lahore hospitals treated 1048/919 cases of guinea worm disease during 1958/1959. As far as we know, the Lahore and its neighbouring districts are free from Dracontiasis. In this data no reference is given to the place from where the disease was contracted or to which the patient belonged. This data, therefore, may lead to wrong conclusions. This record, as a matter of fact, relates only to the cases, who came to Lahore from guinea worm infected areas, for treatment.

Dracontiasis is known to prolong the disability period and therefore affects adversely the socio-economic conditions of the community. Generally poverty, misery and suffering are essential features of an area invaded by this disease.

The present survey was carried out in Taluka Chachro (district

Tharparker) during the last week of December, 1960 and first week of January 1961. A surmises of observations is presented in this note.

CONSIDERATIONS

1 *The Area*—The guinea worm disease is confined to Talukas Chachro, Diplo, Mithi and Nangar Parkar of the Tharparkar district. Its distribution is shown in the map. At present, its distribution appears to be restricted within the limits of desert (Thar), where besides other factors, paucity of wholesome water together with socio-economic structure, the cultural pattern and local traditions and traits, favour spread of guinea worm disease. As soon as the fringe of the desert is reached a liberal vegetation and, plentiful water is sighted, an absolute freedom from guinea worm disease is observed.

The Thar (desert) covers approximately an area of 7480 sq miles. In the North, the desert is bounded by Taluka Omarkot, in the East is the state of [Jasulmir (Jodhpur, India) and in the South it is surrounded by the Rann of Kutch. In the West of the desert lie Talukas Jamesabad and Degri of Tharparkar district and a portion of Hyderabad district.

2. *The People* : The Thar is sparsely populated, with an average of 21 persons per sq. mile. There are in all 159 villages, situated wide apart at considerable distance from one another. A rough estimate of the total population in the area is 164980 people. Of the whole population, the non-muslim, mostly orthodox Hindus, predominate. The muslims comprise only about 10 per cent.

The principal crop is Bajra (*Pennisetum typhoideum*), which is dependent upon the amount of rains every year. It is the staple food of the people. The annual rainfall varies from 3" to 6".

In the Thar area, Dracontiasis normally has a dramatic and sudden outbreak. A large portion of the community is rendered immobile and unfit to attend normal agricultural work. Like malaria, the onset of guinea worm disease synchronises with the sowing season. The outbreak of guinea worm disease in the area, where agricultural needs are acute requiring arduous work on the plough, perpetuate severe famine conditions.

3. *Water Supply* :—In this region, the people obtain their water

supply either from wells or water ponds. Each source has a periodicity.

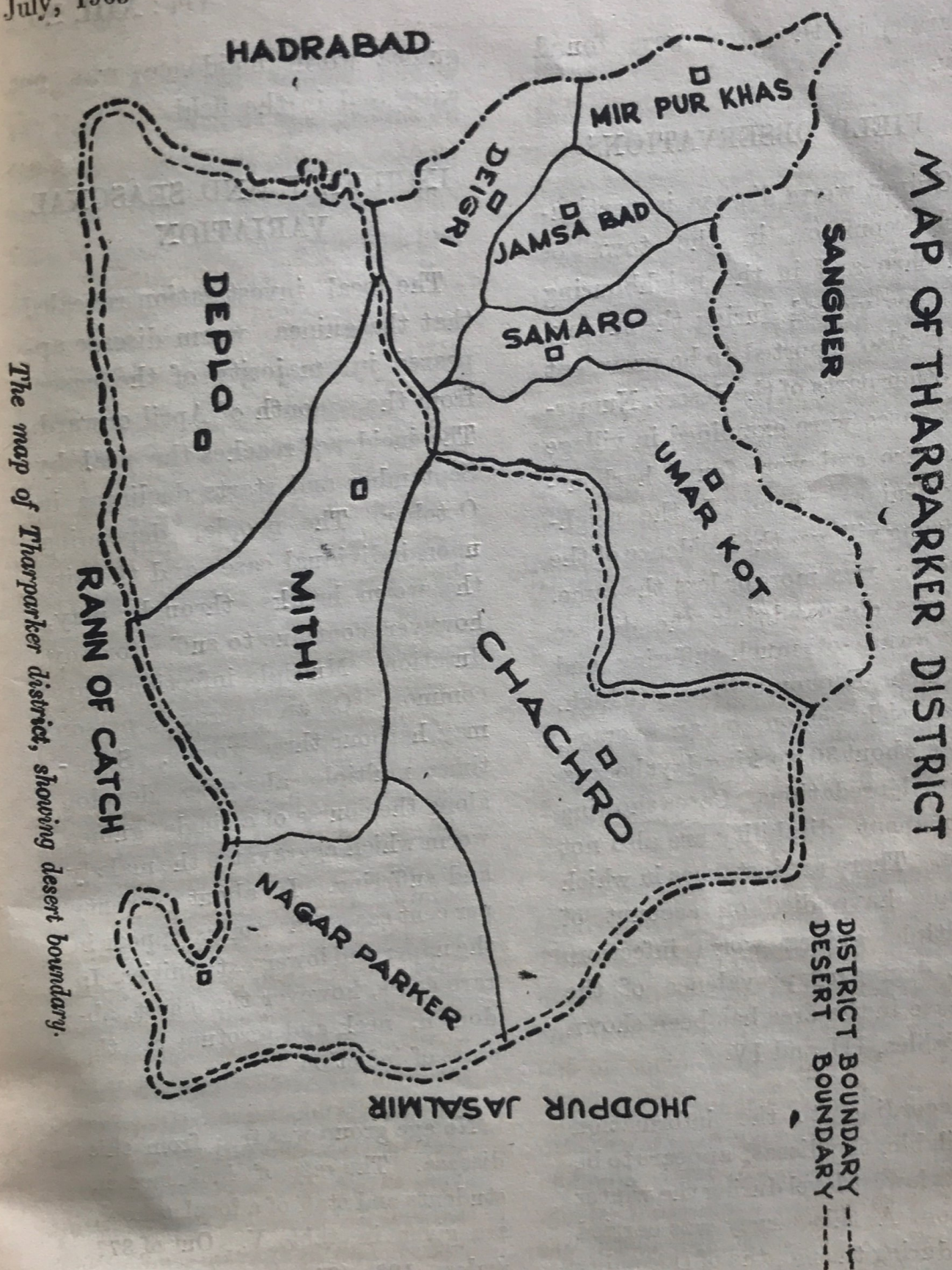
*The Wells :—*Every village throughout the desert has a number of wells. On an average a moderate village may have three wells for every 50 to 100 houses. It was perhaps the availability of water at a comparatively lesser depth which resulted in the accumulation of population near convenient water sources. The comparative degree of palatability of water may have also been conducive factor in the formation of villages.

Generally the water in the wells is brackish. It has unacceptable taste, especially for people hailing from areas outside the Thar (desert). The sub-soil water level ranges from 150' to 250' or more. Draft animals, usually camels are used for drawing water from the deep wells. Water is lifted in large leather bags, of about ten gallons capacity. The bag is fastened to a rope and its other end is hooked to the animal. Due to some religious restriction and prohibitions, the water drawing is entrusted to a professional class of people, specially appointed for this purpose. The amount of water supplied to each house is charged

at a fixed rate. Under the prevailing circumstances this is the only economical method of water supply available to the people. On the whole, it is an expensive method for obtaining a commodity like water for domestic use. Ordinarily 10 gallons of water from the community well costs about Re. 1.00. It is a very high price compared to the low economic level of the people. The well water is normally consumed for about nine months in a year.

*Tarai or ponds :—*As soon as the rainy season sets in and water accumulates in ponds, the wells are abandoned and the Tarais become source of water supply for the villagers. The rain water usually collects at certain low-lying points. Usually each pool is formed in the bed of a desert stream. These water collections or Tarais usually last for 2 to 3 months in a year. With the passage of time, the Tarai water gets highly polluted and even stinks on account of putrefication of organic matter. However, this water is preferred over the well water-mainly because it is available without cost and is comparatively sweeter in taste. At the time of our visit all the ponds

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The map of Tharparker district, showing desert boundary.

(Tarais) in the area were found dry.

FIELD OBSERVATIONS

Guinea worm disease is particularly common in the town of Chachro and in the neighbouring villages visited during the survey. It is also reported to be prevalent in other parts of the desert. Numerous cases were examined in village Chachro and were found harbouring Guinea worm. In the neighbouring villages the incidence of the disease was more or less the same. It was observed that the disease was cause of much suffering and anguish. Economic losses are high. Each sick person, on an average, loses about 30 working days because of its depredations. Cases showing permanent disability are also not rare. There are instances in which people have died on account of multiple guinea worm infection. The degree of prevalence of the disease in the area has been shown in Tables, III and IV.

According to the information available, the disease appears to be at its lowest level during the winter season. As this survey was carried out during the months of December, January, the peak of the active

guinea worm incidence was not witnessed in the field.

INCIDENCE AND SEASONAL VARIATION

The local investigation revealed that the guinea worm disease appeared in majority of the cases, from the month of April onward. The incidence reaches the peak by September and starts declining in October. The people, depending upon individual case and the site the worm breaks through, may, however, continue to suffer for any duration. Multiple infections are common. On an average a person may harbour three worms. Sometimes multiple abscesses develop along the course of a single guinea worm which aggravates the malady and suffering. In about seventy per cent cases, the worms appear in the upper and lower extremities. In rare cases, however the chest, abdomen, neck and scrotum are the seats of infection.

No age group was free from this disease. The rate of incidence in students and staff of a local school, are given in table V. Out of 377 males, 128 (34 per cent) were suffering or had suffered from this

disease. Amongst female out of 187 girls in various age groups 48 (25.8 per cent.) were suffering or had suffered from this disease. The female seems to be attacked less frequently than males.

It may be of interest to know that according to local information the disease had been recently re-introduced in the Thar area. It was reported that a few decades preceding the inception of Pakistan in 1947, guinea worm disease although formerly present, had vanished and the entire area remained free of this disease for nearly forty years. The disease again appeared in this area in 1948 and has since been rampant there as witnessed at the time of this survey. It was also reported that the incidence of guinea worm disease across the border, in the Indian territory, is similar and restricted within the limits of the Rajasthan Desert.

THE INTERMEDIATE HOST

Nearly all the wells in six villages and towns visited during this survey were examined. Three wells out of 20 wells examined had cyclops. The number was one to two cyclops per dip in approximately four gallons of water drawn from the

wells. On examination, none of the cyclops was found infected.

By the side of each well, especially in the town of Chachro, there existed a small cement tank for watering the cattle. The water spilled from the leather bucket collected in these tanks. These tanks did not dry up as fresh water continuously flowed into these throughout the period the well was in use. The water from these tanks was examined and in each dip of the photographic tray $6" \times 9" \times 1"$, a dozen or more cyclops were recovered. This observation denotes that these tanks function as hatcheries and maintain colonies of cyclops for a considerable duration in the year.

HUMAN HOST

The local community consists of leanly built and sickly people. They appeared under-fed, under-nourished, victim of mal-nutrition and deficiency diseases and rank low on socio-economic scale.

Beside Dracontiasis, malaria and diseases of gastro-intestinal tract are common. Medical aid is conspicuous by its absence, except in some big towns like Chachro. Due to lack of communication, insufficient means of transport, and ignorance,

the people of these villages are generally not much inclined to avail medical facilities. Distance is the most important factor in this regard. In towns, where hospitals and dispensaries exist, the medicine supplies are limited and inadequate. The daily attendance is usually thin. People ordinarily consult quacks (*vaids and hakims*). The local system of medicine is preferred and relied upon more than the modern system of medicine. Government dispensary is usually considered to be seat of surgical treatment, especially for the treatment of guinea worm disease. To them this method adds fuel to the fire, increases agony and enhances pain. There is general hatred and aversion towards western method of treatment.

Cultural patron, customs and beliefs were found contributory factors in the establishment of guinea worm disease in these communities. Aesthetic values with regard to the use of water seems to have been outmoded by traits and traditions. Water lifted from the ground, irrespective of visible suspended debris, is sacred and pious for the common man of the region. It is considered to remain clean even with bathing

wading and washing. These practices facilitate liberation of guinea worm larvae in the Tarai water and infect the cyclops present.

Before finally filling the utencil, it is emptied and washed in the Tarai. It is a usual practice and is instrumental in the introduction of cyclops from the utencils to the Tarai water. The agent, the host and the environmental factor are thus brought together and result in the chain of events necessary for the establishment of the disease.

Schools exist only in towns and large villages. A major portion of the population is illiterate and indifferent to seek the light of knowledge. There is a high school in Cachro town in addition to a primary school for boys and middle school for girls. Fair number of students attend the primary classes but the number of students steadily declines in the higher classes.

The concept of sanitation and cleanliness is relatively better than in some other localities of West Pakistan except for the consumption of water. Had it not been for the low economic level, paucity of water, absence of fresh edibles and too few institutions for treat-

ment, the state of health in these communities would have been comparatively better. Inherently, people are clean and tidy and have well scrubbed houses. Preference of Tarai water is culturally permissible and relieves economic pressure for a short while and hence people are not appreciative of the dangers involved in drinking unclean Tarai water.

DISCUSSION AND CONCLUSION

This survey amply demonstrates the presence of guinea worm disease in the communities examined. Its wide prevalence has not only impoverished the health of the people but also severely hampered their social mental and economical structure.

The ecology was found perfect for the agent of disease to thrive and most suitable for the intermediate host to flourish. The human-host was found culturally and economically pre-disposed to accept the worm. People are indifferent to strain water before use because they are ignorant of its importance.

The ecological triad, specific host, agent and environmental factors is essential for establishment of a disease. If due to one or the other

causes the ecological triad is turbed or imbalanced the disease either disappears or its incidence declines. It seems that the essential requisits for the spread of guinea worm disease in the community of Chachro are available to give it chances of firm hold.

It has been stated above that in this area the onset of the disease in majority of cases is sudden and restricted to a well defined period. As the incubation period, in which the worm may appear superficially, is about twelve months, it seems obvious that the sharp increase of cases during a limited period is due to certain set of events which occur in a specified time and culminate in the appearance of cases of guinea worm disease. The epidemiological evidence hence, impinges on the relationship of village communities to the Tarais (pond), which appear to have direct association with the incidence of guinea worm disease in the area. The possibility of contracting the infection by consuming well water is ruled-out, in view of the epidemiological pattern of the disease as well as on the ground that the community well with a depth ranging between 150' to 250' and with a width of

hardly 2', is not likely to contain a particular generation of cyclops for at least ten days (till they are infective) when the total amount of water withdrawn from each well virtually empties the well by each evening. The cyclop population in the wells was low at the time of the visit. This number may however, increase several fold in the favourable season. It will still be highly inconceivable to recover ten day old cyclops from any well on any one day.

Morthy (1938) has shown that infected cyclops require higher oxygen contents than normal for their survival. On this basis as well, the possibility of finding infected cyclops in the deep well is highly remote. It seems probable therefore, that only those cyclops are infective which are found in shallow Tarai water, where it is congenial for them to survive long enough after the entry of the larval worm, and be ingested in due time to be able to infect man.

The Tarais were dry at the time of this visit. A report from Medical Officer of the Dispensary, at Chachro however, mentions profuse cyclop breeding in samples of water from Tarai examined during

the period the Tarais were in use. The method by which the cyclops are introduced in the Tarais during emptying and filling the water utensils has already been explained. The reservoirs or hatcheries of cyclops, which are maintained all the year round, and around each well, have also been discussed. This leaves absolutely no doubt in incriminating the Tarais as a chief source, from which the guinea worm infection is propagated to the population of the area.

With regard to the control of guinea worm disease in this area, the information that this disease remained absent for a long time and has been reintroduced only recently is considered important. What actually happened in Nature is not known, however, it denotes that if such a thing can be repeated, artificially or in Nature, this disease may vanish once again. A continuous dry spell for some years could have induced such a situation but no rainfall records were available to confirm this presumption. It is, however, still suspected that due to drought and absence of rains for some years, the Tarais remained dry and people were forced to obtain water from the wells alone. It is

further presumed that the spell of dry season and the absence of Tarai was long enough in which the former infection in man died out and when favourable weather conditions returned the causative agent was missing.

Guinea worm disease is a preventable disease in this area and the solution lies in preventing the public using the Tarai water and providing water points from which people may draw water without entailing any cost. Health education programme can be effective if only the people are made to realise the dangers involved in consuming the water from Tarais. It was observed that in certain houses a special piece of cloth is maintained for straining water before drinking it. A few samples of the straining cloth were collected and actual straining process was witnessed. It was found, that although straining of water could be highly potent in preventing the disease, neither the cloth used was fine enough to

hold back the cyclops nor the people cared to stick to strain through one side of the strainer. This discrepancy undoubtedly resulted in undoing the preventive operation.

No age group was free from the disease. A few well-to-do families in the village who maintained a better standard of sanitation and cleanliness, and did not use Tarai water despite religious and cultural permissibility and used the straining cloth properly were observed to have escaped the Guinea Worm infection.

Although the data presented is insufficient to draw definite conclusions, the evidence cited above is of considerable significance in incriminating water from the Tarais or ponds in the spread of guinea worm disease in the region. If somehow or other, the association of the man with the Tarai water is successfully interrupted the Guinea Worm disease will not only be eliminated but will also be eradicated.

TABLE : I SHOWING THE NUMBER OF GUINEA WORM CASES TREATED IN HOSPITALS AND DISPENSARIES IN VARIOUS DISTRICTS OF WEST PAKISTAN IN 1958-1959.

1958				1959			
Districts		No. of Cases		Districts		No. of Cases	
Lahore	.. ..	1048		Lahore	.. ..	919	
Rawalpindi	.. ..	913		Sialkot	.. ..	105	
Bahawalpur	.. ..	206		Tharparkar	.. ..	263	
Bahawalnagar	.. ..	1050		Thatta	.. ..	1	
Rahim Yar Khan	.. ..	173		Dadu	.. ..	15	
Dera Ismail Khan	.. ..	478		Larkana	.. ..	90	
Tharparkar	.. ..	202		Sukkar	.. ..	13	
				Jacobabad	.. ..	11	
				Hyderabad Sanghar and Khairpur	.. ..	NIL.	

TABLE : II MONTHLY HOSPITAL ATTENDANCE OF GUINEA WORM CASES (MALES AND FEMALES) AT CHACHRO IN 1959-60.

Month	Non-MUSLIMS			MUSLIMS			TOTAL		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
November	2	..	2	..	2	..	2	..	2
December	..	..	..	..	..	..	..	..	..
January, 1960	..	..	..	..	..	..	..	..	..
February	..	..	..	..	..	..	..	..	..
March	..	1	1	1	1	1	1	1	2
April	..	..	..	..	..	..	..	..	..
May	..	..	..	1	1	1	1	..	1
June	1	..	1	..	..	..	1	..	1
July	6	5	11	1	1	2	7	6	13
August	5	3	8	2	1	3	7	4	11
September	6	2	8	3	..	3	8	3	11
October	2	1	3	3	..	3	5	1	6
November	..	..	..	..	1	1	..	1	1
December	1	..	1	..	1	1	1	1	2
Total	23	12	35	11	4	15	33	17	50

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TABLE : III SHOWING INCIDENCE OF GUINEA WORM DISEASE IN CHACHRO TOWN BY AGE AND SEX AND RELIGION IN A SAMPLE OF 260 CASES.

Age	NON-MUSLIMS			MUSLIMS			TOTAL		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-4 ..	1	..	1	1	..	1	2	..	2
5-9 ..	6	1	7	..	..	..	6	1	7
10-14 ..	5	4	9	..	..	..	5	4	9
15-19 ..	22	..	22	1	..	1	23	..	26
20-24 ..	22	1	23	4	2	6	26	3	28
25-29 ..	30	6	36	4	1	5	34	7	40
30-34 ..	44	5	49	4	2	6	48	7	55
35-39 ..	26	..	26	..	..	..	26	..	26
40-44 ..	31	2	33	5	..	5	36	3	37
45-49 ..	7	1	8	1	..	1	8	1	9
50-54 ..	6	..	6	1	..	1	7	..	7
55-59 ..	1	..	1	..	..	..	1	..	1
60-64 ..	6	3	9	2	..	2	8	..	11
65-69 ..	1	..	1	..	..	..	1	..	1
70 Onwards ..	3	..	1	..	..	..	3	..	1
Total ..	211	23	232	23	5	28	234	26	260

TABLE : IV SHOWING INCIDENCE OF GUINEA WORM IN PROFESSIONAL WATER DRAWERS IN CHACHRO.

No. of Persons Examined	No. of Persons found positive	% of Incidence
12	12	100%

TABLE : V SHOWING INCIDENCE OF GUINEA WORM DISEASE AMONGST STAFF AND SCHOOL CHILDREN AT CHACHRO BY AGE AND SEX.

Age	Boys				GIRLS			
	Total	Active cases	Suffered before	Incidence %	Total	Active cases	suffered before	Incidence %
5-9	210	24	40	30.45	130	4	19	17.6
10-14	95	6	34	42.1	47	7	15	46.8
15-19	54	4	17	38.8	..	..	..	..
20-24	18	1	2	16.6	10	2	1	30.0
Total	377	35	93	33.9	187	13	35	25.6

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EXPLANATION TO THE PHOTOGRAPH

PLATE : I

1. A desert well without a parapet.
2. A village well—water being drawn by animals (bullocks and camels).
3. Approximate depth of the well is shown by the camel standing in the yonder end.
4. Another village well, showing the leather bag used for water lifting.
5. A village woman, shown carrying water from the well.
6. The cattle—watering tanks (function as hatcheries for cyclops).

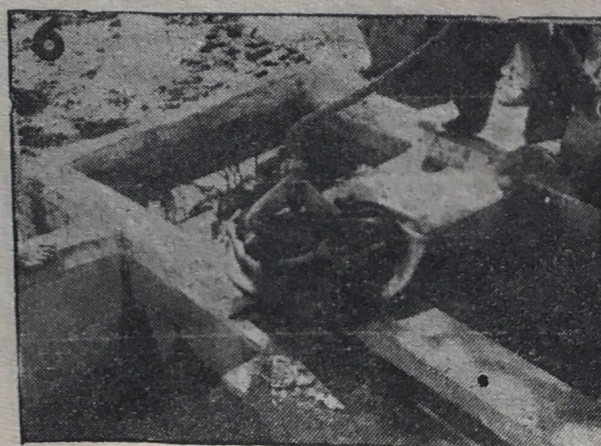
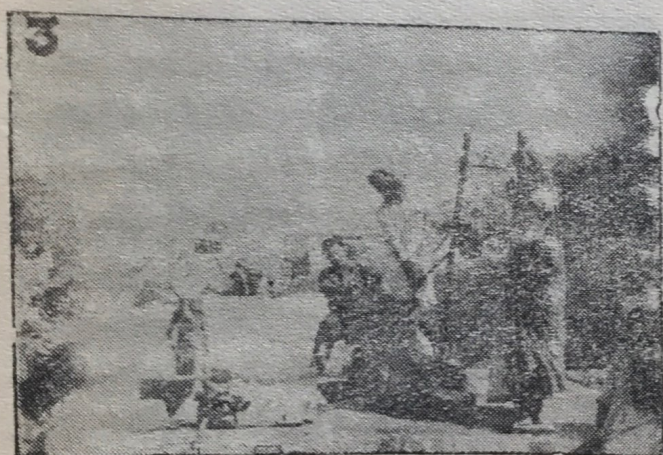
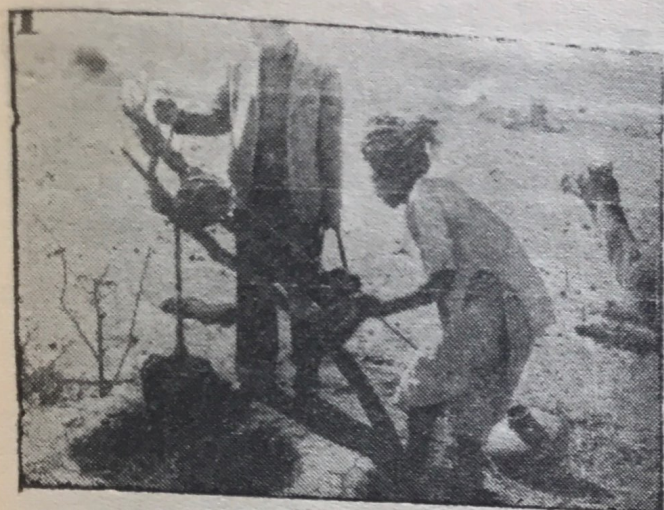
EXPLANATION TO THE PHOTOGRAPHS

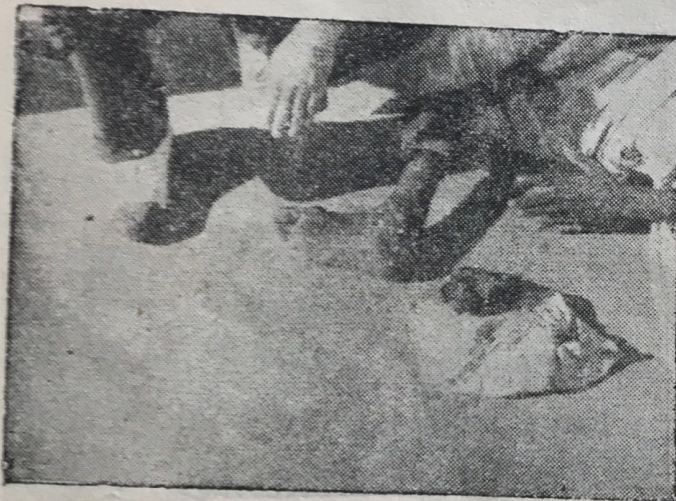
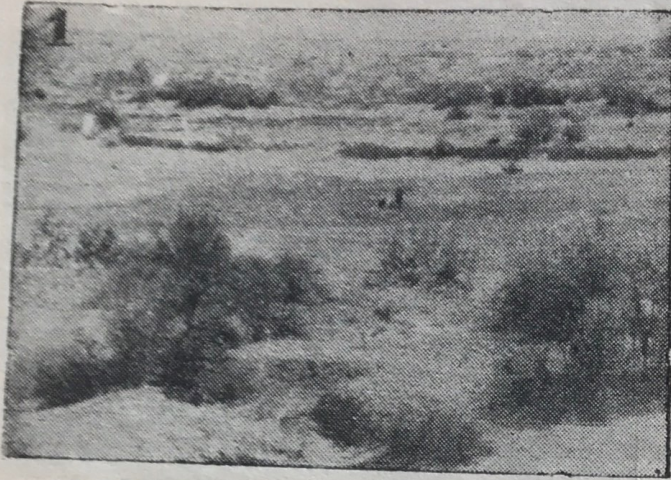
PLATE : II

1. A typical Tarai, seen in the dry season.
2. Another Tarai in the desert area.
3. A typical case, showing ulceration of the ankle.
4. Another victim of guinea worm disease.
5. A typical house in a desert village.
6. Village well not in operation. Water being carried from the cattle—watering tanks.

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CHILD AND THE ACUTE HOSPITAL

By

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Increasing awareness of the hazards of hospitalisation necessitated reorientation of the paediatric hospital establishments. The American Academy of Paediatrics and the British Medical Association have made comprehensive recommendations to mitigate some of the adverse effects which might result from this procedure. Emphasis is laid in these reports on the measures designed to prevent the child from psychological trauma and the prevention of cross infection in the hospitals. Useful guidance is provided in making the hospital experience for the child as less unpleasant as possible. The value of taking the child into confidence through sympathetic consideration and explanation is stressed. The hospitals present a less formidable environment for the child patient. In

this country the problems are of a different nature and it is desirable to review these difficulties in this article.

SOCIAL ASPECTS

Invariably the mother is admitted with the child in hospital. Contrary to expectation this does not appear to interfere significantly with the home structure. Due to the traditional system families tend to live together and it is not difficult to find a mother substitute to officiate at home for her during her stay in hospital. Also women do not go out to work and this influences the availability of other female members to look after the house. One hundred mothers were interviewed in two leading paediatric units in West Pakistan and the results are tabulated below:—

Age of Patient	Socio-Economic Status	Duration of stay in Hospital	% Mother living with Child	% Other relatives Living	% Child Living alone
1/12 to 12 years	Low (97%) High (3%)	1-60 days	89 %	9%	2%
MATERNAL PROBLEMS					
Home Worries	Food Difficulties	Sleeping Difficulties	Worries about Lactating Children		
3%	Slight 66%	90%	10%		

Mothers generally visit their homes and children daily or less frequently if they so desire, to satisfy themselves of the adequacy of their home set-up. The analysis shows that majority of them did not express significant concern about their homes. Further we have found that very few mothers in low income groups desire to leave hospital because of domestic considerations. We have recently tended to relax regulations in allowing breast fed babies to be retained by mothers in hospitals. Social difficulties as a factor against hospitalisation needs to be interpreted judiciously.

THE PROBLEM OF CROSS INFECTION

Numerous communications are available on the subject in Western literature. For over half a century numerous epidemic and case reports of infections especially by staphylococcus aureus have been published. Fraenkle in the beginning of century first drew attention to the respiratory infection caused by Staphylococcus. Wide-spread dissemination of Staphylococcus in environments of children were reported (Cass). Kabak and Pilot found 75% infants under one year to have developed staphylococcal anti-

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bodies in their blood. The incidence of staph infection in nurseries was lowered from 6.54% to 0.630 by Farquharson using various drugs. Mc Khan however pointed out that the main problem of cross infection in infant hospitals is the prevention of respiratory infections and that duration of hospitalisation influenced the incidence of such infections. Carriage of staphylococcus aureus in hospital environment has been extensively studied and pathogenic staphylococci have been isolated from the nose, throat, axilla, skin, perineum etc, of the hospital staff.

Staphylococcal pneumonia as such is uncommon in these parts of the country and resistant strains of *S. aureus* are seldom encountered. The sensitivity figures for *S. Aureus* at the pathology department Nishtar College are tabulated below :—

Total Number of Cultures	% of Positive Staph : Cultures	% of Other Organism Cultures	Sensitivity			
			P.	S.	T.	C.
710	(3.0) 22 cases	44.4	2	9	20	9
P :	Penicillin					
S :	Streptomycin					
T :	Tetracyclin					
C :	Chloromycetin					

It is unusual for respiratory infections to develop while the

child is in hospital. Nursery epidemics of Staph : respiratory infections are uncommon. Gastro intestinal cross infections occur in some paediatric units and nurseries explainable mostly by maternal ignorance of food hygiene. These cases have been generally of a mild sporadic nature and have seldom necessitated closure of the concerned units. It appears that children are more likely to develop gastro-enteritis in their own environment than in hospitals where adequate precautions are enforced. It is obvious that cross infections in children's hospital is not a substantial problem at the moment in these parts of the country. It is wise however not to relax the measures already in use for the prevention of cross infection. Whether resistant strains will eventually develop remains to be seen.

PSYCHOLOGICAL ASPECTS

Hospitalisation produces some degree of emotional upset in most children but particularly in under four years old, especially if they are detached complete from their families. Children are dependent for their needs on

certain individuals, usually mothers and separation may affect them adversely. The unpleasant routine and experiences in and around the hospitals might aggravate the above. Western hospitals realised this hazard and have modified their environment and routines to make them as less formidable as possible. Visiting is encouraged, delays are avoided through efficient appointment system, recreation is provided at hospitals, painful procedures are pursued after explanation to the child with liberal use of local anaesthetics. Children units are detached, and maintained away and independently from other hospital units to prevent unpleasant sites and noises from adult wards. Wards are made as homely as possible. Children are prepared in advance for the hospital experience through explanation, suitable toys, picture books, of doctors and nurses and hospital equipment and a visit or two to the concerned units before admission.

In this country as mentioned above it is a routine for the mothers to be admitted with the child in

hospitals. This single factor-plays a great part in alleviating the psychological trauma mentioned above. Mothers ensure that their children in hospitals are well provided and accompany the children if they are required to be sent out of the ward to other investigatory units. They are also available when minor painful procedures are performed on the child.

Health Teaching—Advantage is taken of the maternal stay in hospitals to educate them about the feeding of their children. They are told about the general principles of hygiene and child care and advised about prevention of disease including immunisation. They assist the nurses thereby reducing the work load, and in so doing acquire valuable health knowledge.

General considerations—Our problems at the moment are of a more general nature like personnel shortage, inadequate funds, poor nutrition and other factors due to rapid socio-economic changes. These difficulties we hope will eventually be overcome and children's hospitals will play a leading role in curing disease and in disseminating

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useful paediatric knowledge around the country.

SUMMARY

The different set up of our

paediatric hospitals is mentioned. The hazards to the child in hospital are reviewed. The place of a paediatric hospital in the health programme is indicated.

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BOOK REVIEWS

A PRIMER OF PATHOLOGY,
by F. A. Ward, LRCPI, L.RCSI,
LM. (Rotanda). (Pp. 116 + viii.
15s.) London: Butter-worths.
1962.

This book has 36 short chapters and guides the beginner to how to learn pathology. Dr. Ward has used many similes. For example he tells us that without the works of Aschoff and Maximow reticulosis would be "like a beatnik's nightmare". Dr. Ward's book will be of help to those who want to revise the subject in a short time.

THE HAEMOLYTIC ANAEMIAS. Part one. The congenital Anaemias (Pp. 339 + viii. 54s.)
2nd Ed. 1963 (Reprint).

Part two. The Auto-immune Anaemias. (Pp. 378 + vi 50s.)
2nd Ed. 1962. By Prof. J. V. Dacie, MD., FRCP. London: J. & A. Churchill Ltd.

The first edition was published as a single volume in 1952. Professor Dacie was now revised and divided it into three volumes. The first two volumes are under

this review. The first volume deals with congenital haemolytic anaemias and haemoglobinopathies. Abnormal haemoglobin syndromes have been incorporated in the present edition. Part 2 deals with the auto-immune haemolytic anaemias, their causes, pathogenesis and treatment. Professor Dacie has given a clear account of the haemolytic anaemias. These volumes will be of much interest to the Physician.

PRACTICAL SECTION CUTTING AND STAINING, by E. C. Clayden. (Pp. 198 + vii. illustrated)
London: J. & A. Churchill Ltd.,
4th Ed. 1962.

This practical hand book on histological techniques has been revised. It would be a useful guide for the technicians in morbid histology.

THE MICROBIAL FLORA OF THE MOUTH, by K. A. Bisset, D.Sc., and G. H. G. Davis, Ph.D., (Pp. 100. 22s. 6d.) London Heywood and Company Ltd., 1960.

This book provides an account of the microbial flora of the mouth. Each chapter has useful appendix giving practical details about isolation etc., of micro-organisms. It is a useful reference for the Dental students and the bacteriologist interested in this field.

CALLING THE LABORATORY.
Edited by W. A. R. Thomson, M. D.
(Pp. 112 + xi) Edinburgh and London : E. & S. Livingston Ltd. 1962.

This book incorporates a series of articles published in the Practitioner under the title 'Calling the Laboratory'. It is an informative book giving the principles of different tests and what materials are required for submission to the laboratory. Most of the chapters have lists of useful references. This book will be of interest to the General Practitioner,

FIRST YEAR CLINICAL NOTE-BOOK, by P. M. Wilkinson. (Pp. 128 + vii. 12s. 6d.) Edinburgh and London : E. & S. Livingston Ltd. 1963.

It is meant for the Student Nurse going to the wards and has been written by an experienced Tutor. It deals with the signs,

symptoms and investigations of conditions commonly met within the wards. It will be of much help to the student nurse.

HUMAN NUTRITION AND DIETATICS by Sir Stanely Davidson and R. Pressmore. (Pp. xii + 887 ; 90s.) Second Ed. 1963. London and Edinburgh : E. & S. Livingstone Ltd.

"Human Nutrition and Dietatics" is a well written and adequately illustrated book. It has been thoroughly revised and brought uptodate. Valuable diet sheets have been appended at the end of the book. It will prove to be an excellent reference book for the students and the physicians,

HANDBOOK OF MEDICAL LABORATORY FORMULAE, by R. E. Silvertown and M. J. Anderson. (Pp. xii + 676 ; 90s), 1961, London Butterworths & Co., Ltd.

This book has been written by experienced medical technicians. It give a comprehensive information required by the medical laboratory technologists. The reagents have been classified into four main sections viz., bacteriological, and parasitological, histopathological,

haematological and biochemical. Useful appendixes dealing with atomic weights, stain solubilities and logarithms etc., are given at the end of the book. It will be a

useful guide for these engaged in the Medical Laboratory Work.

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ENERGY FROM THE FOOD YOU EAT

By

CLINICUS

It is the fashion among sportsmen whose energy is flagging to take glucose. Mothers give it to their children. Tired business men suck it in trains. Glucose is an excellent source of calories and provides a fillip to the jaded.

But the really knowledgeable do much better. They take a spoonful of cod liver oil. Now if you say: "What a horrible idea. I should have to hold my nose while someone forced it down," you just haven't tried modern oil, which is quite pleasant to take. And if you think that the sole purpose of cod liver oil is to supply vitamins, and you prefer those in a pill, you are quite wrong.

Vitamins are certainly necessary to avoid deficiency diseases, but we are discussing energy, vitality, joie-de-vivre. How, in, fact, to cure that sinking feeling.

The oil provides more calories than glucose. Two glucose tablets

supply about 40 calories. A tablespoon of oil, 150. But, more important than that glucose is very quickly digested, absorbed and used up. It gives a quick effect but not a lasting one. Fat has more staying power. Digestion and absorption take much longer, so that empty feeling never develops, and the onset of fatigue is delayed.

The high energy value of fats makes them essential for people doing heavy work, for children, and for everyone in cold weather. But calories are not all. Plenty of fat, lazy people stuff themselves with calories, but have no energy.

To be energetic you must be healthy, and fats are essential to health. Some fats, not others. You seem there are different sorts of fats. People who eat buns all day get fat. The body actually turns excess starchy and sugary food into fat and deposits it as a spare tyre. Go on a strict reducing diet, and

this fat is used up to supply energy. It yields our old friend calories. But it has no protective value at all. It won't keep you healthy.

To the chemist, fat is a compound of glycerol and a fatty acid. It is the sort of fatty acid that matters. There are two kinds: Known as saturates and unsaturates. Saturates form stable compounds, but unsaturates form unstable ones able to take part in important chemical reactions in the body. For good health, the unsaturates are vital.

In experiment, rats fed on a diet without unsaturates stopped growing, got emaciated, their hair fell out, they had kidney troubles. Babies on a diet deficient in these acids get eczema, which clears up when the diet is corrected.

So it is important to know what sort of fat to eat. At one time, animal feeding stuffs contained quite a lot of vegetable oil, which found its way into our meat. Modern processing results in feeding stuffs with very little oil. So beef and pork fats for instance don't give you what you need.

Again, much vegetable oil is now made into margarine. But the very

process of hydrogenisation, which creams it up, destroys unsaturates. So our modern diet tends to be deficient in this respect. If we want to keep really well, we have to look round for a better source of unsaturated oil. The answer is either a vegetable or a fish oil. There has lately been a vogue in some special diets for corn oil. This contains about 85 per cent of unsaturates. But the true efficiency of these substances depend on their degree of 'unsaturation on', which varies. Chemically, we speak of the number of 'double bonds' it contains. This just means its capacity for forming other compounds in the body. The more double bonds, the more things it can hook on to, as it were. The unsaturates of Corn oil have either one or two double bonds. Twenty five per cent of the unsaturates in cod liver oil have as many as 4, 5, or 6 double bonds and are often called polyunsaturates. For good health, there is little to beat the addition of a tablespoonful of cod liver oil to the daily diet. Old prejudices die hard. Years ago, children often rebelled against the fishy taste. When synthetic vitamins became available, mothers thankfully used them instead for the sake of peace, not realising that

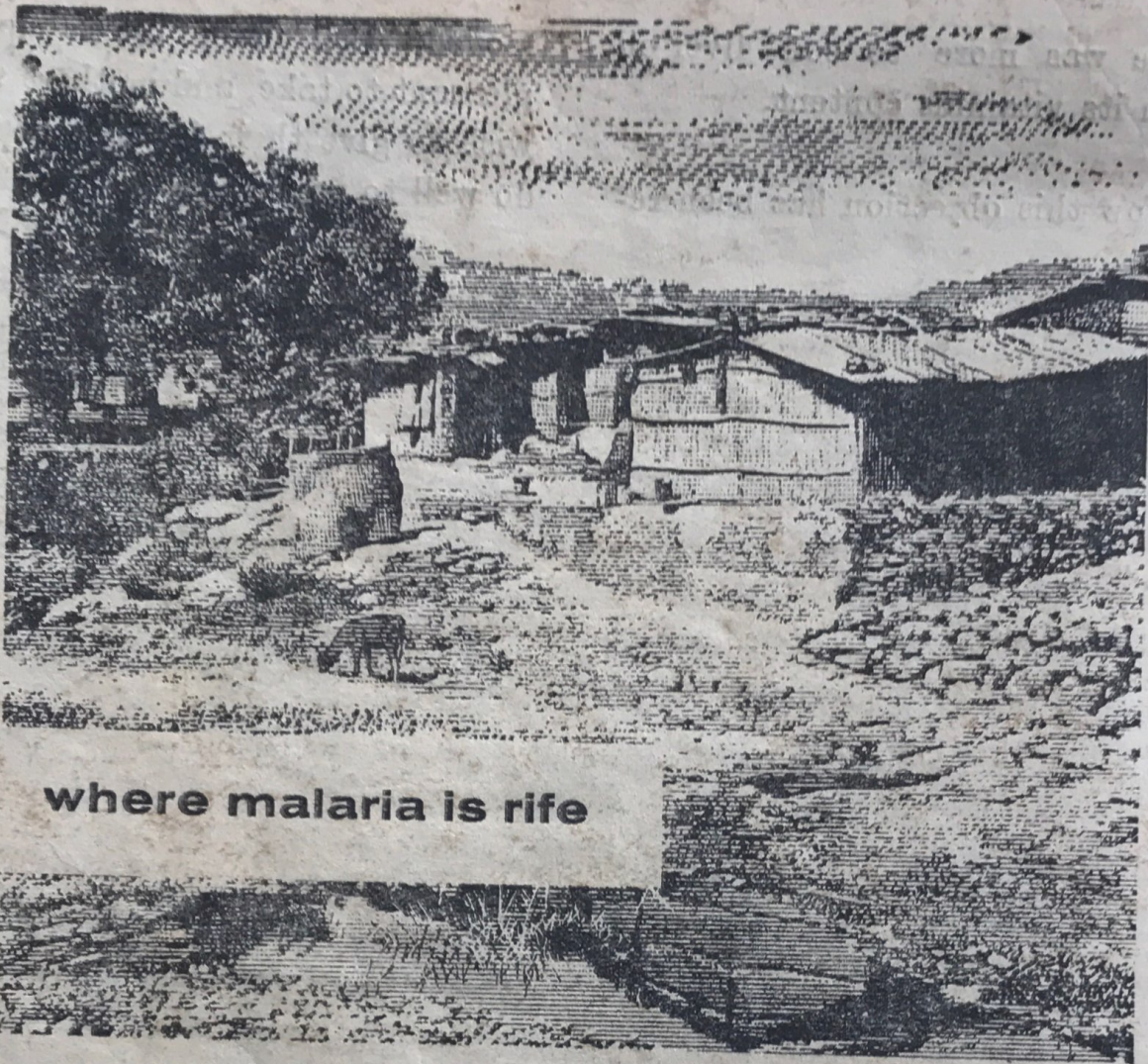
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there was more to cod liver oil than its vitamins content.

Now this objection has been re-

moved, Cod liver oil is quite pleasant to take, and mothers who wish to give their families energy do well to use it again.



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