die from a hypodermic injection of quinine. I have had them die where I attempted to give it by the mouth and by inunction or by any other methods except hypodermically. They have not died when the quinine has been administered in that way.

In answer to the question relative to the apparent leucocytosis, if you consider the time of the year and the fact that we have no symptoms of any trouble in the lung, that sign would be almost pathognomonic.

SOME FACTORS IN THE PREVENTION OF MALARIA.

By WILLIAM H. DEADERICK, M.D.,
Hot Springs, Ark.

THE MILLS-REINCKE PHENOMENON AND HAZEN'S THEOREM.

Shortly after a filtered and purified water supply was installed in Lawrence in 1893, Mr. Hiram F. Mills, of the Massachusetts State Board of Health, observed that there was a decided decrease not only in the number of deaths from typhoid fever but from other diseases as well. Almost simultaneously Dr. J. J. Reincke, Health Officer of Hamburg, noted a similar result on the death rate of that city, following an improvement in its water supply.

Based on the experience of these observers and his own observations in Albany and Troy, Hazen in 1904 evolved the following theorem: "Where one death from typhoid fever has been avoided from the use of better water, a certain number of deaths, probably two or three, from other causes, have been avoided."

The deaths from diseases other than typhoid which have been prevented by improvement of the water supply are diarrhoea, cholera infantum, and other gastro-intestinal diseases, pneumonia, pulmonary tuberculosis, and bronchitis. Aside from the reduction of the death rate from typhoid and other diseases there has been a perceptible improvement in the general health of the community.

I venture the postulate that *if through drainage one case of malaria is prevented at*

least one case of sickness from other cause is prevented.

Diseases other than malaria which we might hope to influence through drainage are:

1. Those conveyed through contamination of drinking water:
 - a. Typhoid fever.
 - b. Enteritis.
 - c. Cholera.
 - d. Intestinal parasites, etc.
2. Those conveyed through soil pollution favored by soil moisture.
 - a. Typhoid fever.
 - b. Hookworm disease.
3. Those conveyed by aquatic bred insects:
 - a. Yellow fever.
 - b. Dengue.
 - c. Filariasis.

RESIDUAL AND COMPLEMENTAL MALARIA.

It is the duty of every community to furnish its citizens with a wholesome water supply. Typhoid fever which is eliminated through purification of the public water supply is known as "water-borne" typhoid, and that which remains is called "residual" typhoid.

It is likewise the duty of the community to destroy at least those breeding pools which through the production of anopheline mosquitoes endanger the health of the neighborhood and not merely the occupants of the premises. This should be regarded as a minimum essential. After such destruction the malaria which remains and concerns chiefly the occupants of the infested premises may be regarded as residual malaria. The malaria which has been eliminated in reducing the rate to the residual may be termed "complemental" malaria. It follows that complemental malaria is a community problem and that residual malaria is largely an individual problem.

CHOICE OF METHOD.

If there is anything demonstrable by results of past experience in the prevention of malaria it is that no one method of prophylaxis

laxis is universally applicable. In prophylaxis as well as in therapeutics the remedy must be adapted to particular indications and the vaunting of a universal method is on a par with prescribing a nostrum as a cure-all.

In the Canal Zone, Havana, and India, mosquito prophylaxis has been relied upon chiefly; in Italy, quinine; at Ismailia, both mosquito destruction and quinine; at Klang and Port Swettenham, mosquito destruction alone, and in a recent campaign in California, mosquito destruction and education.

A belief in the possibility of complete eradication of malaria is not visionary provided it is not to be attempted by any single method alone. A one method campaign over an extensive territory would in most instances result in a reduction to an irreducible minimum more or less remote from complete eradication. The analogy between the complete eradication of malaria and of yellow fever fails in two important particulars: First, the popular dread of yellow fever which unites the public to co-operate with the health authorities; secondly, in yellow fever there is no carrier problem, which is big in malaria.

The prophylactic measure best suited to a particular locality depends largely upon whether the problem is essentially a community problem or an amalgamation of individual problems; whether it is a problem of complementary or of residual malaria; or, in other words, whether a few breeding pools are responsible for the malaria of the entire locality or whether each householder is breeding his own stock of anopheles which infect his household only. Much of this finally rests upon density of population. It further obtains that possibility of radical destruction of breeding pools is usually in direct ratio to density of population.

Universal quinine prophylaxis is impossible to enforce. Discriminative quinine prophylaxis, considering only cases and carriers, is almost as difficult for these reasons:

1. Many cases are not seen by physicians.
2. Radical cures are not effected.

3. Carriers are difficult to determine.

4. Carriers are difficult to sterilize.

Even if every parasite in the United States were destroyed and no attention were paid to mosquitoes every imported case of malaria or malaria carrier would rekindle the endemic and the campaign would have to be repeated.

Quinine prevents only one disease, has no collateral benefits, and has even been suspected of producing quinine resisting forms (*chinin-fasten malariaparasiten*).

That there is an irreducible minimum consequent upon quinine prophylaxis alone is demonstrated by the experience in Italy where this method has been tried more thoroughly than in any other country and much more thoroughly than could, for social reasons, be hoped for in the United States. The following table from Celli (Proceedings of the Third Meeting of the General Malaria Committee Held at Madras, Nov. 18-20, 1912. Simla, 1913), demonstrates this and shows that during the last three years covered by the report the disease has actually increased.

STATE QUININE AND MORTALITY FROM MALARIA
IN ITALY.

Financial Year.	Kilograms Sold.	Calendar Year.	Mortality from Malaria.
		1900	15,865
		1901	13,353
1902-03	2,242	1902	9,908
1903-04	7,234	1903	8,513
1904-05	14,071	1904	8,501
1905-06	18,712	1905	7,838
1906-07	20,723	1906	4,871
1907-08	24,351	1907	4,160
1908-09	23,635	1908	3,463
1909-10	21,656	1909	3,533
1910-11	22,795	1910	3,619

Celli (loc. cit.) pessimistically concludes: "No remedy, therefore, quinine not excepted, is always effective in enabling us to eradicate malarial infection at will; and so not even with the most accurate inter-epidemic and pre-epidemic treatment—much less with the kind of sanatorium that gathers in little carriers of plasmodia without the means of curing them all permanently and effectively—can we believe it possible for malaria to be exterminated (*hoc opus, hic labor est*) in an extensive locality already overrun by the disease."

The far-reaching results of unconscious prophylaxis, the unintentional elimination of malaria from former hotbeds of the disease, have been accomplished largely through abolition of breeding pools in the march of civilization.

Mosquito prophylaxis is radical; the mosquito is the definitive host of the parasite.

It is easier to locate breeding pools than malaria carriers; it is easier to abolish breeding pools than to educate the profession and the public to the importance of radical cures.

Besides the prevention of malaria, drainage possesses three collateral benefits.

1. Prevention of other diseases.
2. Riddance of disagreeable pests.
3. Reclamation of land.

If it is feasible to eradicate malaria by the destruction of mosquito pools, this is certainly the method of choice. Why live in a locality which necessitates the systematic use of a drug when that locality can be rendered thoroughly sanitary?

It is usually possible, especially in densely populated communities, to eradicate complementary malaria radically by attacking the anopheles. Drainage is therefore particularly a community problem. Where the problem is an individual one or an amalgamation of individual problems and destruction of breeding places is impossible, quinine, screens and oil must be relied upon. It is not infrequently the case that residual malaria can be completely eliminated by simple and easy measures directed toward the abolition of pools.

Even after the community has furnished a pure water supply, circumstances may arise when it becomes advisable for the individual to be vaccinated against typhoid fever. Similarly after a locality has eliminated complementary malaria quinine may have a role. Its value will be in inverse ratio to the density of population.

There is one mighty weapon in the campaign against malaria which has been all but neglected in past campaigns, excepting a recent one in California, and that is education.

The public should be made familiar with the etiology of the disease, practical preventive measures, and especially with the public health significance of the latent or carrier stage. It cannot be denied that many adult inhabitants of malarial sections of this country could not be educated up to practical malaria prophylaxis even with concentrated effort throughout a long life time, but by devoting careful attention to their children and to their children's children a generation of malaria fighters would be bred.

QUININE-FAST MALARIAL PARASITES; A MEMORANDUM.

By H. R. CARTER, M.D.,
Senior Surgeon U. S. Public Health Service,
Baltimore, Md.

Without going into the subject of malarial relapses, which is a very big one, this much seems true.

When a man is suffering from a malarial infection which from time to time develops into malarial fever, the parasites must exist in him during the interval between the attacks although not in sufficient numbers, or in such a form as to produce an attack of fever. When enough asexual forms are produced from them to provoke systemic reaction, the relapse is produced. During the interval there seems no evidence that they, the parasites, exist in any other form than as we usually know them, or in any other tissue except the hematocytes, although, of course, both are possibilities. The increase of asexual forms should come, then, from the proliferation of the parasites in the ordinary way, and the daughter-parasites should, more or less, partake of the characteristics, original and acquired, of those from which they spring.

In relapsing malaria quinine may be given during the attack sufficient to cure it and to destroy the greater part of the asexual parasites, so that there are not enough left to keep