Brilliant specialists and general practitioners will undoubtedly continue to hold sway with remunerative practice among the rich. In increasing measure they will, it would seem, give part time free to the poor as they have so generously done in the past. The incompetent doctors will continue to struggle along in the rear as incompetents in all human endeavor have done since time immemorial. They will continue to divide their time neither with the rich nor the poor, but just with themselves. The great body of sterling, capable physicians seem to be increasingly recognizing the fact that prosperity, congeniality, and stimulation attend closer affiliation with the expanding mechanism of community medicine. The speed of this readjustment will depend on the efficiency with which the leaders in the community medicine movement develop its advantages, and the effectiveness of the educational campaign among doctors through which they may in increasing numbers learn to see where their permanent interests appear to lie.

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MALARIA CONTROL FROM THE ENGINEERING POINT OF VIEW

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Control of malaria is vital to the industrial development of the South and other warm regions and the engineer is vital to malaria control. The public must coöperate by understanding and by supporting improvements. Here is a plain educational statement of high value. It views the problems from many practical sides and suggests fundamental considerations.

MALARIA is the South's greatest problem. It affects 3,000,000 people and causes an estimated economic loss of $1,000,000,000 yearly.

Economically its insidious influence is felt by the banker and merchant, and by every business man whose prosperity is dependent upon the prosperity of the region he serves. The lumberman, the farmer, and every other employer knows that malaria is lowering the efficiency of his laborers, is reducing his production, and decreasing his profits. Rarely a fatal disease, it so lowers vitality that the fatality rate of other diseases is increased. But, most serious of any of its effects, is the handicap it places upon the child. To be enervated by malaria, during the years when the body should be developing into a sturdy, dependable machine, the mind and will growing and strengthening to correspond, means an appalling loss that can neither be calculated nor recovered. The solution of the problem lies with the engineer.

In studying the control of malaria, we must first consider the factors of its transmission, which are: A person infected with malaria—the anopheles mosquito—and the well person who may become infected. Thus we derive four lines of attack: Mosquito eradication to eliminate the transmitting agent; protection of well persons against infected mosquitoes by screening; protection of infected persons against non-infected mosquitoes by mosquito bars and screens; and reducing the number of infected persons by quinine treatment. The first three methods are essentially engineering problems.

Since the Stone Age, the problem of diseases and man's bodily ills has been apportioned to the doctors; but, together with typhoid, malaria must now be assigned to the sanitary engineer, with the prophylactic measures left to the physician.

An effective campaign against malaria requires the coöperation of the public, for funds must be provided, and without the support of local officials and individuals the work would be seriously handicapped. The actual direction of the control work should have the closest team work by the physician, the biologist, the laboratory technician, and the engineer.

The physician studies the characteristics of the disease, its means of transmission and its cure. In malaria control, he is the principal factor in prophylactic measures. The biologist studies the habits of the mosquitoes, their choice of breeding places, food requirements, etc. He also investigates the natural enemies of the mosquitoes and their value as active agents in mosquito eradication. In the laboratory, the technician studies the organisms of the disease and the conditions which favor or prevent its development.

The sanitary engineer engaged in antimalaria work uses the data on malaria and its various factors, which have been collected by the physician, biologist, and in the laboratory, to devise the most effective and the most economic methods of controlling the disease.

Mosquito eradication eliminates the connecting link between the infected and the well person, and has proved a most desirable method of malaria control. Not an unimportant consideration is the popular favor which the work gains by adding to the comfort of the people. Though the physician observes the reduction in malaria, the average person notices the comparative scarcity of mosquitoes, and his comfortable evenings on the porch make him feel that he is getting something for his money.

The most effective method of mosquito eradication is the elimination of breeding places. This may require the drainage of extensive swampy areas where the reclamation of land for cultivation will make it economically feasible. Under other conditions the desired results may be accomplished by ditches, or the clearing of small streams, which would seem child's play to the drainage engineer accustomed to big projects. The important feature is not the size of the project but the thoroughness with which the work is done. No one part of the problem may seem great or difficult, but taken in its entirety, it presents a mass of details which must all be solved in order to make the work successful.

Where drainage is not practicable because the cost would be excessive in ratio to the benefits derived, other means must be employed, such as oiling, or fish control. The engineer must determine the most suitable materials and devise the best methods where oiling is used, and it is often necessary to clear the water surface in order to make the methods effective.

The top water minnow, *Gambusia affinis*, is a deadly enemy of the mosquito because of his voracious appetite for mosquito larvæ. Ideal conditions for this method of control are not often found in nature and the engineer is frequently called upon to help the minnow, either by removing vegetation and other protection of the larvæ, or by providing protection for the minnow against larger fish which would devour it.

For the engineer of an inventive turn of mind, malaria control offers a wide field. In mosquito eradication, as well as in other lines of engineering, many local problems will be met which must be solved on short notice and at low cost, without precedents to guide the engineer. This was particularly true of the work in the extra-cantonment areas. No two zones presented the same problems. In one, tide gates were required to allow the drainage of swampy areas at low tide and to prevent their flooding at high tide. In another, vertical drainage was used to drain isolated water sheds with no surface outlet. In yet another, subdrains were installed to provide permanent drainage of marshes. All these are problems which will continue to present themselves, and for which more efficient and less costly methods can undoubtedly be devised.

There is a crying need for ditching machines suitable for mosquito control work, for which a special type of ditch is necessary. The drainage engineer is particularly interested in flood flows, and designs a large ditch, the purpose of which is to carry large quantities of water. The sanitary engineer engaged in mosquito control work is interested in the minimum flows. At such times, the wide flat-bottomed ditch which carries the flood waters will be a series of shallow pools, admirable breeding places for Anopheles. To prevent mosquito breeding a small V-shaped ditch in the bottom of the larger ditch is necessary. Trenching machines used in laying water mains or sewers make a straight-sided, flat-bottomed ditch, which would not be suitable for a permanent ditch. The cost of mosquito control could be reduced, and thereby the work greatly promoted by the development of a small, portable ditching machine, which could worm its way through streams, or ditches, or dig new ditches of the type necessary for this work.

Another problem is that of aquatic growths. It is often necessary to remove pond lilies, moss or other water plants from ponds in order to make oiling or fish control effective. Hand labor is a tedious and expensive method. Aquatic saws are on the market but they are costly and are not entirely satisfactory. In some extra cantonment areas an emergency was met by improvising an aquatic saw from the "licker-in" wires used at cotton mills. This is another opportunity for the inventive engineer.

The original work is the more expensive but maintenance is an expense which will remain, and any means of reducing this cost will do much to advance malaria control. A study should be made of the possibilities of lining ditches, possibly by placing wire netting and applying a thin wall of concrete with a cement gun. The initial cost would be increased, but maintenance cost would be eliminated by preventing the growth of vegetation in the ditches.

A kerosene burner for burning grass and weeds in ditches proved very successful in Panama, but the cost of this method as compared with hand cleaning, has not been determined in this country. With the increasing prices of oils, the question of the most economical as well as efficacious material to use, and the most satisfactory means of applying it, are important problems.

A few problems which present themselves to the sanitary engineer in mosquito control work have been enumerated in order to show that although the possibility of reducing malaria by the eradication of mosquitoes has been proven time and again; there remain opportunities in developing methods and reducing costs.

Screening has been mentioned as a method of malaria control. This is also work for the engineer, and though not a complicated engineering problem, it is another case where thorough work and close attention to detail is necessary. It may be added, that to effectively and economically screen some plantation tenant houses, without building a new house, is a problem which is beyond even the most ingenious engineer.

In malarious sections the control of this disease has an intimate relation with all engineering enterprises. In fact, it may determine the success or failure of an undertaking. We have an excellent example of that in the Panama Canal. The chief reason of the French failure was the demoralization of their forces by yellow fever and malaria. When Mr. John F. Stevens was the chief engineer, he made the statement that there were three epidemics on the isthmus; yellow fever, malaria and cold feet. It was the sanitation of the Zone which made the canal possible.

The same is true, to a variable degree, of any enterprise in a region where malaria is prevalent. On a closely estimated engineering project the availability and efficiency of labor may be the determining factor between profit and loss. With a large percentage of the laborers infected with malaria there is a great loss of time on the part of the laborer, which reduces the available man-power. A considerable percentage of the men who are infected will not be sick enough to remain in bed, but will continue to work. However, their efficiency will be greatly reduced and the employer will be fortunate if he gets thirty cents' worth of work for a dollar in wages from such men. Labor overturn is also an important factor, for the securing of new labor is often expensive. Every employer knows that he will get greater efficiency—which means increased production at less cost—from healthy employees who are working under conditions which keep them satisfied. Such conditions are not possible where malaria prevails.

Engineers are largely responsible for increased malaria in many places. Storage reservoirs for water power projects have been built without considering the vast increase of mosquito breeding places, which could be prevented at reasonable cost, and as a result areas near some of these reservoirs have been practically depopulated. In building railroads and highways, the engineer leaves borrow pits which are not drained; places culverts too high so that ponds are formed above the embankments; and these provide excellent, but entirely avoidable, breeding places for Anopheles and are the cause of unnecessary "man-made malaria."

The control of malaria is vital to the full development of the vast resources of the South. It affects the agricultural, lumber, mining and manufacturing interests, probably more than any other one factor. There are sections in the South which have been practically abandoned by white people because of malaria. As affecting the development of agriculture, it may be stated that the most fertile lands are often found in the sections where malaria is most prevalent, such as the Mississippi Delta.

The lumber camps and saw mills have men idle or working at low efficiency because of malaria. The same is true of cotton mills, steel mills and other industries. With under-production on the farms and in the factories the revenues of the railroads are kept down. Many of the progressive corporations are conducting anti-malaria campaigns. The Tennessee Coal & Iron Company has reduced malaria cases among its employees and their families from about 3,000 to 50 per year. One result of this work is more efficient and contented employees, a condition which must have a wholesome influence on production records.

The railroads are growing more interested in the malaria problem, as it is becoming more evident to them that the disease is causing great inroads on their revenues. The financial benefits derived from malaria control have been shown by the St. Louis-Southwestern Railroad, known as the "Cotton Belt Route." Practically the entire system lies in a malarious region. Beginning in 1917, this railroad has conducted anti-malaria campaigns among its employees and in cities along its lines. One mill operator reported that the output of his mill had been increased 20% by the reduction of malaria. This resulted in an increase of $60,000 in the annual freight revenues of the railroad from this mill. Many similar cases could be cited.

The various industries of the South, the railroads, and the financial interests are rapidly awakening to the importance of malaria control. The engineer is directly concerned with all development, being in many ways the pioneer with the possibilities of new ventures left to his judgment. With the control of malaria, he eliminates a factor which might prove his undoing. From the field party making the preliminary survey for a railroad or a water-power development project, to the employees of a saw mill or a city factory, malaria is a problem which confronts the engineer in the South at every turn. It is a problem which is of the utmost concern to every engineer and not only to the sanitary engineer who is directly engaged in the work.

At the present time an effort is being made to strengthen commercial relations with the South American countries and to build up an extensive foreign trade. Some parts of these countries have a high malaria rate and whether or not measures are taken to control the disease may mean the success or failure of many of the investments made of American capital in these countries.

The engineer is vitally interested in malaria control from a personal and professional point of view. This does not only apply to the sanitary engineer who is charged with the protection of the public health, but is equally true of any engineer who is located in a malarious region, or is connected with enterprises in a section where malaria is prevalent. Human efficiency is a great factor in the success of an engineer or of his undertakings. Human efficiency and malaria cannot occur together. The engineer must secure maximum results at minimum expense, which cannot be done with labor infected with malaria.

The engineer is interested in results, and delights in progress charts which show his accomplishments. If he is engaged in anti-malaria work he will often be discouraged at the lack of visible evidence of results of his efforts for he cannot see his bridge span the stream—his building rise toward the skies—or his dam gradually stem the flow of the river. But he must have vision to see the decrease in human suffering — the saving of life. He must see the child, who instead of starting out in life infected with malaria and the handicaps which that implies, is given an even chance as a result of the fight against this insidious disease. When he can see this, he sees the most important progress chart and he sees malaria control from the engineering point of view -- the greatest benefit to humanity at the least cost.

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National Mine-Rescue Competition at Denver.—With a view of stimulating still further the safety movement among the mines and metallurgical plants of the country, a National First-Aid and Mine-Rescue Contest will be held under the auspices of the Bureau of Mines, Department of the Interior, at Denver, Colo., August 20 and 21, 1920. Mining teams from the principal mining companies of the country will participate, and especially those teams of the west that were unable to attend the national meet, held last year at Pittsburgh, Pa., in which more than 100 teams took part. The contest will be for the national championship in first-aid and mine-rescue work, honors which are coveted by every miners' team in the country. National contest cups, medals and prizes will be awarded to the winners.

D. J. Parker, in charge of the rescue work of the Bureau of Mines, has immediate supervision over the arrangements for the contest. Mining companies intending to enter are urged to get in touch with him at the U. S. Bureau of Mines, Pittsburgh, Pa. The contests will be decided solely according to Bureau of Mines standards and by judges thoroughly familiar with first-aid and mine-rescue work and with Bureau Mines practice.