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Address delivered by Dr. Sergent

on the occasion of the Award of the Darling Medal

to Dr. Swellengrebel.

My dear friend and colleague,

I am deeply gratified at the honour which devolves upon me to-day of presenting you with the Medal that the Committee of the Darling Foundation of the League of Nations Health Organisation awards to distinguished Malariologists. I am particularly happy to do so in the city of your birth, Amsterdam, Queen of the Waters and triumph of human endeavour. It was here, indeed, that you schooled yourself to work; here that, in the words of Descartes - whose name comes so readily to mind in this land of Holland, you were initiated in those "methods that are essential for further advance in the study of nature".

Like that great master, and like Pasteur, you were not content to narrow down your ideal of scientific work to the quest of truth alone, ignoring its applications to the welfare of mankind. The scientist, indeed, should be disinterested: not so science. As a young student you already displayed this twofold tendency, enthusiasm for laboratory work and the desire to do service to your country. I see evidence of this in your inaugural thesis on a bacterial disease ("taches en couronne") which attacks the potato, one of the choice products of Dutch agriculture.

Your training was continued and your outlook broadened by travel and residence abroad. You worked at the University of Zurich, at the Pasteur Institute in Paris in the laboratory of my friend, Amédée Borrel, and in the laboratory of G. H. F. Nuttall at Cambridge. As a member of the Malaria Commission of the League of Nations, you went on study tours to the Balkans, Italy, Russia, the Near East where you were the companion of our lamented fellow-worker, Darling, at the time of his fatal accident; you travelled to Spain, the United States and British India, and you were also invited on mission to South Africa by the Government of the Union.

Thus, journeying all over the globe, you sought for truth "in the great book of the world", and your ceaseless co-operation with the scientists of many nations affords a fine example of that free brotherly understanding which the

men of goodwill in all countries should establish, in the service of science, so that mutual comprehension on the plane of thought may pave the way for true international friendship.

Coming of a seafaring race which has spread and prospered mightily in distant lands, you turned naturally to the problems of exotic pathology on which the discoveries of A. Laveran and Patrick Manson had just thrown new light. You studied the great pestilences of the hot countries, doing research in co-operation with others, and at the same time teaching your students at the University of Amsterdam: plague epidemiology and prophylaxis in Java and in the Netherlands; the morphology and evolution of the dysentery amoebae studied in Sumatra; cytological observations showing that certain spirochaetes at least have greater affinities with bacteria than with protozoa; normal and pathological morphology of the trypanosome of the rat in its invertebrate host, the flea.

You were struck by the need, for the study of diseases of hot countries, of a thorough acquaintance with the invertebrates which are the second hosts of many parasites of man or the higher animals. In your research into plague and rat trypanosomiasis, you had to experiment with fleas, lice and bugs. More and more you came to favour what you have termed the "popularisation" of entomology amongst doctors dealing with exotic pathology.

Nowhere more than in the study of malaria is a knowledge of entomology necessary, the best proof is to be found in your own work, and to this I hasten to turn, for it is your work on malaria which the Darling Committee has been specially anxious to acknowledge.

From 1911 to 1913, whilst on a mission in the Dutch East Indies, you studied malaria and anopheles in Sumatra, then from 1916 to 1919 throughout the Malay Archipelago in collaboration with Madame J.W.H. Swellengrebel.

Lastly, since 1920, you have been studying the epidemiology and prophylaxis of malaria in your home country, in collaboration with M. KORTEWEG, M. SCHÜFFNER, M. de BUCK, Mlle. SCHOUTE, M. de ROOK, M. TILLEMA, and M. DOORNBOSCH.

Your studies of malaria in the Dutch East Indies led you, as you have said yourself, to this main conclusion that effective mosquito control calls for the most minute knowledge of the biology not only of the various species but of the different varieties, races or types of anopheles in each species; for tiny morphological differences may reflect quite large biological differences, a knowledge of which is of outstanding importance for the prophylaxis of malaria.

For instance, you refer to the Anopheles ludlowi, which is a dangerous carrier of malaria. Inside the Island of Sumatra this anopheles lays its eggs only on fresh water; in the Island of Java, on the other hand, it lays them only on brackish water; on the fresh water of that island only the larvae of another anopheles, A. rossi, which does not propagate malaria, are found. If anti-larval measures had

had to be applied in Java to all the breeding places of anopheles larvae, both in fresh and in brackish water, the expenditure would have exceeded the available credits; whereas anti-larval measures limited to the brackish water breeding places have been perfectly feasible. Thus the knowledge of a very special biological fact, namely, the difference in the predilections of the Javanese and Sumatran A. ludlowi as regards breeding sites has had consequences of great practical importance.

The conclusion which follows is that it suffices to combat the most dangerous species or varieties of anopheles and to direct anti-larval measures against their favourite haunts, neglecting the breeding grounds of less dangerous species or varieties, as culicinae are nowadays neglected. To circumscribe the scope of the campaign is to decrease expenditure. You have called this restricted campaign against the anopheles "species sanitation".

You point out that the instability of the characteristics of anopheles in the East Indies (A. ludlowi, A. hyrcanus, A. aconitus, A. maculatus, A. umbrosus), which you reported before 1914, is perhaps only superficial and is due to the existence in each species of varieties or races or even forms not discriminated by the entomologist but of which the health expert must take account if characteristics such as the instinct governing the choice of breeding place are hereditary and if cross-mating with neighbouring forms is impossible. To make such distinctions you say there is no need for entomological specialists: every malariologist should also be an entomologist.

Your study of malaria in the Malay Islands led you and SCHÜFFNER to an interesting observation on the immunity of the natives in tropical countries where malaria is endemic. In hyperendemic areas the premunition acquired by the Malays takes the form in the adults of a very great decrease in the plasmodium rate, contrasting with the persistence of the spleen rate. On your mission in South Africa you were surprised to observe the opposite phenomenon amongst the black natives; in the adult negroes of hyperendemic areas the plasmodium rate remained high, while the spleen rate was greatly reduced. In this connection, I may say that, unlike the African negroes, the Malays behave like the native white populations of North Africa. Changes in the blood parasitism and in the degree of spleen enlargement which accompany the acquisition of premunition, are the same for both the Malays and the white inhabitants of North Africa, whereas the tendency is reversed in the African negroes.

Your return from the Indies to your home country in 1920 coincided with a fresh wave of malaria in the Netherlands. Observation of the epidemic, which specially affected North Holland, strengthened you in your conception of "species sanitation".

Of this you drew a masterly picture in your survey of malaria in the delta of the Rhine, that is, those low lying plains along the estuaries of the Rhine, the Meuse and the Scheldt, which are the scene of endless warfare between land and sea, and which form the greater part of the Netherlands. The history of malaria in the Rhine delta shows how, unwittingly, the labour of man may create malarial foci, and afterwards, just as unwittingly, destroy them. You have explained how these two successive and contrary phenomena are due to differences in the habits of two varieties of a single species of anopheles, A. maculipennis. Everywhere else, deltas are formed by the slow accumulation of the alluvium brought down by the great rivers, which gradually raises the coast above the level of the sea. In the Netherlands the bold handiwork of man has hastened the encroachment of the land on the sea. Where a few years ago the fisherman's boat tossed on the gray waves, a dam raised out of the waters has enabled the sea bed to be quickly dried. The polder which allows the water to drain away does not raise the level of the land and does not prevent sea water from filtering through the dyke. But the fresh water of the rivers gradually removes the salt from the former sea bed, and although newly created polders are brackish, in the old polders it is fresh water which fosters the growth of the lush meadows where browse the celebrated black and white cows; the small headed, massively built fine horned Dutch cattle.

You have told us why the brackish polders are malaria infested and why they cease to be so when they are no longer salt. The answer is simply that they are not inhabitable in both cases by the same anopheles. And yet, the only species of anopheles existing in the Netherlands is A. maculipennis. The patient investigations pursued by yourself and your fellow workers from 1926 to 1934, showed that the salt-water anopheles were not exactly the same as those that live in fresh water. Were they different species? They were rather different varieties. But the fact is that certain slight differences in structure are associated with physiological differences of great importance to human pathology. You have thus established the following points:

In the Netherlands human beings are infected with malaria in autumn, but the Plasmodium (which is always P. vivax) has a long period of latent pre-clinical infection, or delayed incubation. The acute attack appears only in the following spring or summer.

Of the two varieties of anopheles occurring in the Netherlands, the atroparvus, whose larvae are to be found in brackish water, lives as a winged insect during autumn and winter in heated houses, and it awakens occasionally from its winter sleep to take a blood meal, without laying eggs after biting, as mosquitoes usually do.

On the other hand, the messeae variety, whose larvae are to be found in fresh water, does not live in houses in winter and does not bite after mid-August.

The conclusion is that malaria, a disease which is contracted in Holland in autumn, is certainly not carried by messeae, which do not bite in autumn; it is carried by the atroparvus which is the only variety that bites in autumn.

As the atroparvus originates in brackish water and the messeae in fresh water, the danger of brackish polders and the harmlessness of those from which the salt has been removed are explained.

The history of the Dutch polders thus affords us a fine example of man-made malaria afterwards eradicated by the progress of human work.

In the Netherlands one method of species sanitation is suggested by the way in which impounded land frees itself from malaria. In the evolution of the polder the brackish water stage could be omitted and the polder be from the first free of salt. This is exactly what is being achieved in the splendid reclamation work in the region of the Zuyder Zee. In the midst of the four polders which are being made, a great reservoir has been retained, the lake of the Yssel, which is constantly fed with fresh water by the Yssel and protected against the sea by the dam which runs from northern Holland to Friesland. The water which will filter into the polders surrounding the lake of Yssel will be fresh and their anopheles the harmless messeae.

Thus, in penetrating the secrets of nature, the scientist succeeds in eliminating what is harmful in them, thereby making nature subservient to the good of mankind, and fulfilling the prophecy of Descartes: "The development of science will enable the forces of nature to be used for all purposes for which they are suitable and will make man master and possessor of nature."

Fellow worker and friend, the Committee of the Darling Foundation of the League of Nations, in awarding you its medal and its prize, has desired to pay a tribute to the brilliant way in which your painstaking research has latterly contributed to the progress of the epidemiology and prophylaxis of malaria.

I have pleasure in presenting you, on behalf of the Darling Foundation, with this token of our heartfelt esteem.

EDMOND SERGENT.