THE RISE AND FALL OF THE TREPONEMATOSES*

I. ECOLOGICAL ASPECTS AND INTERNATIONAL TRENDS IN VENEREAL SYPHILIS

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The world has known tidal waves of disease for a long time. There were the early plagues of Egypt in Pharaonic times and the "great sickness", under the Roman emperors, and smallpox began to occur in epidemics, invading Arabia, the Roman Empire, France, and other countries before the Middle Ages. The bubonic plague crossed from Asia and spread into Europe in the 13th and 14th centuries, and in the 15th and 16th centuries the "English sweat" struck rich and poor in many parts of Europe. In the 17th century yellow fever began to ravage American cities. The spread of cholera as a world-wide disease belongs to the history of a single century—the 19th—and in the 20th century came the outbreak of the "Spanish influenza" at the end of the first world war.

These examples of the rise, spread, and fall of communicable diseases in the last 2,500 years are important for the study of epidemic processes, including pandemic, epidemic, and sporadic outbreaks, and regressions of diseases, but from a secular viewpoint such tidal waves have thrown only limited light on the phylogenic and evolutionary processes of human infectious diseases believed to have been associated with man during his more than half a million years of existence. In this long-term perspective the tidal wave of venereal syphilis which spread through Europe after the year 1500 A.D. is a relatively recent event—and it seems of limited importance whether the disease came from the New World with the return of Columbus, or its pre-Columbian existence in Europe manifested itself through better identification due to the epidemic proportions of the outbreak.

Secular changes in the nature, spread and extent of the treponematoses have been suggested by Hudson (1946, 1965), Cockburn (1961), Willcox (1960), and others, as related to evolutionary

processes in time and place, to treponeme mutation through the ages, and to the adaptation of treponemes to environmental conditions. Hackett (1963) suggested that the primitive human treponematoses was in fact Pinta which arose from animal infection about 15,000 B.C. in the Afro-Asian land mass, spread all over the world, and later became isolated in the Americas. Yaws arose by mutation and spread in the tropical world apart from the Americas. Endemic non-venereal syphilis arose about 7000 B.C. in arid climates, and venereal syphilis evolved from it with the development of cities in S.W. Asia around 3000 B.C., and spread as a "mild" disease. A mutant arose towards the end of the 15th century and resulted in the venereal syphilis of the present day. Hackett thinks that venereal syphilis was subsequently carried to the treponemally non-involved regions of the world with the European expansion of the 16th and subsequent centuries. This view of the treponematoses has received renewed interest with the recent findings by Fribourg-Blanc, Niel, and Mollaret, 1966; Fribourg-Blanc, 1967a) of commensal treponemes in the lymph glands of FTA- and TPI-reactive, but otherwise symptomless, monkeys in some parts of Africa. Lymph gland material from these monkeys (species) has given rise to yaws-like lesions by passage in hamsters (Fribourg-Blanc, 1967b), although little information is yet available on the nature and extent of this extrahuman reservoir.

The prevalence of the treponematoses has undoubtedly shown periodic changes—epidemiological processes superimposed on general long-term trends. Changes in the ecological balance may have given rise to periodic recurrences or cycles lasting several years. On the other hand transient variations may have occurred, such as are associated with seasonal climatic changes in tropical yaws, intensifying direct contact and transmission of contagion among children during the rainy seasons which lead

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to indoor crowding. In venereal syphilis transmission relates to direct mucous membrane contact and fundamental human behaviour as well as to facilitating or restraining forces in the environment, which have come to be of broad educational, economic, and social nature.

In the first part (Part I) of our present study of ecological aspects and international trends in the treponematoses, we propose to assess variations in the incidence of venereal syphilis in relation to medical and public health developments, economic, social, and behavioural changes, and the roles of migration and tourism as well as of population control in the epidemiology of this adult treponemal disease.

In the subsequent part of this study (Part II), the trends in the endemic treponematoses of childhood (yaws, pinta, and endemic non-venereal syphilis) in relation to mass campaigns, the rapid fall of their clinical prevalence under the impact of community-wide application of long-acting penicillin and the results of random evaluations of these campaigns are analysed in the light of the contemporary interest in the "epidemiology of disappearing disease".

Trends in Venereal Syphilis

Information on the frequency of venereal disease in the armed forces is often available before similar information concerning civilian populations. Also frequency in the military tends to reflect the civilian reservoir. Data in the United Kingdom show that the rejection rate because of clinical syphilis of candidates offering for enlistment in the armed forces fell from 160 per 10,000 in 1870 to less than 16 per 10,000 in 1910 (Royal Commission, 1916). In the British Army itself the incidence of syphilis was 132 per 1,000 men in 1881 and 118 per 1,000 in 1891. But over the next 80 years these rates were to show a marked continued recession until recent times—interrupted only by periodic recurrences associated with outbreaks of war or warlike operations at home

and abroad. Such a pattern has been documented in other countries also, *e.g.* in the United States of America (Fig. 1) the annual venereal disease rate per 1,000 strength from 1840–1960 showed epidemic peaks at the time of the Mexican war, the Civil war, the Spanish-American war, and the two world wars. A general recession of disease is nevertheless evident over the last 100 years. Since the graphic presentation is all-inclusive it does not show up the Korean war with case rates of 150–200 per 1,000 men per annum (1951–2). In the current Vietnam conflict the rate is 280 per 1,000 (*Navy Times*, 1967).

In the civilian population, parallel trends can be discerned in the late 19th and the early 20th centuries. Thus, the incidence of acquired syphilis from 1880 to 1965 in the capitals of the Nordic countries (Fig. 2, opposite) reflects the outbreak of wars in periodic recrudescences of disease in the civilian populations, whether the countries were neutral (as in the first world war) or enemy-occupied (as were Norway and Denmark in the second world war). Other peaks are probably associated with overseas wars, *e.g.* the Russo-Turkish war in the 1880s and the Russo-Japanese war at the turn of the century, in which Scandinavian shipping was deeply involved and importation of disease to the home country was frequent. The general recession of disease over a long period of time is nevertheless evident. This fall in morbidity was reflected also in the decline of deaths from syphilis complications. Thus the crude death rate from syphilis at all ages in England and Wales, which was 89 per million in 1875, had fallen by 1910 to less than half, and in 1960 was only 11 per million. The death rate due to congenital syphilis also followed a similar long-term pattern of recession (Table I, opposite).

Late and late latent syphilis reflects the prevalence of untreated early infectious syphilis 5 to 20 years earlier (Durel, 1959) as well as the effectiveness of treatment of early syphilis at that time.

FIG. 1.—Venereal disease trends in United States army, 1840–1960. Annual rates per 1,000 strength (adapted from Moore, 1943).

FIG. 2.—Acquired syphilis in Scandinavian capitals, 1880–1965. Annual rates per 10,000 population.

FIG. 3.—Rates of primary and secondary syphilis, early latent syphilis (less than 2 years duration), late and latent syphilis, and congenital syphilis (per 100,000 population) reported in U.S.A., 1941–65.

TABLE I
DEATH RATES PER 1,000 LIVE BIRTHS OF INFANTS UNDER 1 YEAR CERTIFIED AS DUE TO CONGENITAL SYPHILIS IN ENGLAND AND WALES, 1930–1964*

Year	Death rate per 1,000
1930	0.45
1940	0.16
1941	0.21
1943	0.23
1947	0.09
1958	0.004
1964	0.001

*Ministry of Health (1964).

Fig. 3 shows the trend in late and late latent syphilis as well as congenital syphilis from 1941 to 1965 in the U.S.A. It also shows the recurrence of early syphilis associated with the second world war—its regression after 1948—its recrudescence since 1959.

That this fall and rise has taken place on a global scale is shown in Figs 4, 5, 6, and 7, in which the percentage variation of annual incidence rates is presented, using 1950 as the reference point (=100 per cent.).

Fig. 4 (overleaf) shows such variations in four countries in the Americas for which data are available for 1950 to 1965.

Fig. 5 (overleaf) shows the proportion of early syphilis in the total cases diagnosed from 1949 to 1964 in syphilis clinics in two departments in Brazil (São Paulo) and Argentina (Rosario) and in one University Clinic (São Paulo). The data from U.S.A. are incomplete and do not include military cases, e.g. from some countries now serving as recreational areas in connexion with the present Far Eastern armed conflict.

FIG. 4.—Reported primary/secondary cases of syphilis in four countries in the Americas, 1950–65. Yearly percentage variations in incidence, taking 1950 as 100 per cent.

FIG. 5.—Early syphilis (primary/secondary) as percentage of all cases diagnosed in São Paulo Province, Brazil, 1949–64, and in Rosario Province, Argentina, 1955–64.
 * 4266 cases of syphilis all forms diagnosed in 1949.
 ** 208 cases of syphilis all forms diagnosed in 1950.
 *** 351 cases of syphilis all forms diagnosed in 1955.

Fig. 6 (opposite) shows the variations in incidence of early syphilis in six African and Asian countries.

Fig. 7 (opposite) shows the variations in incidence in nine European countries. This requires little comment, except to note the clear tendency to recrudescence in most of the countries included. Whether the trend in France and Italy in 1964–5 is temporary or not will be followed with interest in the next few years. The same applies to a reported downward trend (King, 1967) for 1966 in United Kingdom (not shown on the graph).

Syphilis is notifiable in 57 per cent. of 126 countries throughout the world. Table II (overleaf) shows, however, that this applies to only 39·42 per cent. of European countries, compared with up to 91·7 per cent. in the Americas. In 24·2 per cent. of European countries information was readily available for the entire study period of 1950 to 1965, against 12 per cent. of countries in the Americas (Table III, overleaf), and information for the entire period was not available for any other country in the World. Tables II and III thus show the limited attention

FIG. 6.—Reported primary/secondary cases of syphilis in six African and Asian countries, 1950–65. Yearly percentage variations in incidence, taking 1950 as 100 per cent.

FIG. 7.—Reported primary/secondary cases of syphilis in nine European countries, 1950–65. Yearly percentage variations in incidence, taking 1950 as 100 per cent.

TABLE II
NUMBER OF COUNTRIES IN WHO REGIONS WHERE SYPHILIS IS NOTIFIABLE

Region		Africa	Americas	E. Medi- terranean	Europe	S. E. Asia	W. Pacific	Total
No. of Countries		30	24	18	33	9	12	126
Countries in which Syphilis is Notifiable	No.	15	22	7	13	4	10	71
	Per cent.	50.0	91.7	38.9	39.4	44.4	83.3	56.3

TABLE III
COUNTRIES IN WHO REGIONS FOR WHICH ANNUAL INCIDENCE DATA ON SYPHILIS ARE AVAILABLE, 1950-1965

Number of Years for which Incidence Data are Available Each Year between 1950-1965	Number of Countries by WHO Regions													
	Africa		Americas		E. Medi- terranean		Europe		S. E. Asia		W. Pacific		Total	
	No.	Per- centage	No.	Per- centage	No.	Per- centage	No.	Per- centage	No.	Per- centage	No.	Per- centage	No.	Per- centage
0	12	40	10	41.7	9	50.0	8	24.4	5	55.5	3	25.0	47	37.2
1-5	2	6.7	1	4.1	3	16.7	2	60.6	—	—	1	83.3	9	7.2
6-10	5	16.7	3	12.5	2	11.1	3	91.0	1	11.1	2	16.7	16	12.7
11-15	11	36.6	7	29.1	4	22.2	12	36.3	3	33.3	6	50.0	43	34.2
Entire Period 1950-65	—	—	3	12.5	—	—	8	24.2	—	—	11	—	11	8.7
Total Countries	30		24		18		33		9		12		126	100.0

paid by many countries to furnishing the systematic morbidity data on syphilis which would make it possible to evaluate long-term trends in incidence. (The numerical data on which the previous illustrations have been based showing number of cases reported and estimated incidence rates, including similar information for other countries in different regions of the world are shown below in Annex 1, pp. 242).

From the foregoing it is noted that the recent increase in the annual incidence of early syphilis apparently commenced around 1956 to 1959 and has

continued with some individual variation. At the same time a remarkable fall has taken place in the incidence of congenital syphilis since 1950 (Fig. 8), although minor percentage variations have occurred. The fall has levelled off since 1960 and congenital syphilis is still not infrequent in some countries (absolute case numbers and incidence rates are given below in Annex 2, pp. 242). That a certain proportion of pregnant women continue to have evidence of past or present syphilis is also suggested by the sero-reactor rates even in countries with highly developed health services (Table IV, opposite).

Fig. 8.—Reported incidence of congenital syphilis in eight countries, 1950-65.
Yearly percentage variations in incidence, taking 1950 as 100 per cent.

It is obvious that the data in the foregoing illustrations are not always directly comparable owing to differences in the nature and completeness of morbidity and mortality reporting and statistics. Nevertheless, such information gives a valuable indication of long-term trends (WHO, 1964).

Medical and Public Health Aspects

(a) Improvements of diagnosis by darkfield examination and the Wassermann test in 1906 and the subsequent introduction of Salvarsan in 1909 did not immediately affect the epidemiological trends of infectious syphilis. Only after 1920 did effective metal treatment schemes based on clinical experience come into general use (League of Nations, 1935). They undoubtedly contributed to hasten an already evident general downward trend in the next decennium. The introduction of penicillin in syphilis therapy was certainly a major cause of sharp decline in infectious syphilis after the second world war (Malgras, 1967). But this development could not prevent the recurrence which has taken place since 1956-7, although there is no evidence that the treponemicidal power of penicillin *per se* has

decreased (Collart, Borel, and Durel, 1962; Yobs, Olansky, Rockwell, and Clark, 1965).

(b) Finger (see Haustein, 1927a) suggested in 1920 that, following "mass-infection" of syphilis, acquired immunity would again be "lost" in the next generation, and that this change in the volume of susceptibles played a major role in cyclic variations of the disease. This basic consideration—also observed in many other infections—is in accord with subsequent evidence that immunity towards re-infection generally develops in untreated syphilis (Chesney, 1927). It is also in accord with subsequent evidence that metal therapy applied in courses of subcurative treatment doses over a prolonged period did not substantially obstruct development of such protective immunity (Eagle, Magnuson, and Fleischman, 1947). In contrast to this, adequate treatment of early syphilis with treponemicidal antibiotics will obviate a prolonged stimulus of the immunity mechanism, preventing long-term resistance to re-infection (Thomas, 1949). In fact, in population groups with high exposure rates, re-infections after penicillin treatment have emerged as an epidemiological problem ("repeaters").

TABLE IV
RESULTS OF SEROLOGICAL TESTS FOR SYPHILIS IN PREGNANT WOMEN
IN FIVE EUROPEAN COUNTRIES AND IN THE U.S.A.

Country	Year	Number Examined	Percentage Reactive	Source
Denmark	1950	About 90,000 Yearly	0·08	Nielsen (1967)
	1955		0·01	
	1960		0·01	
	1965		0·04 (Syph. I and II + early latent syph. Excl. late latent syph. and TPI neg.)	
England and Wales	1955	87,122	0·21-0·43	Ministry of Health (1955, 1960, 1965)
	1960	107,955	0·08-0·14	
	1964	130,774	1·12-0·20 (primiparae-multiparae)	
France	1958	71,240	0·4	France (1966)
	1960	80,595	0·5	
	1965	66,599	0·4	
Norway	1944-48	4,961	0·89	Idsoe and Vogelsang (1950) Vogt and Grelland (1953) Eng (1959) Loe (1964)
	1948-63	176,702	0·78	
	1948-63	170,000	0·22 (TPI test)	
U.S.A.	1954	44,868	1·2	American Social Health Association (1962, 1964, 1967)
	1962	1,032,621	0·8	
	1963	1,017,268	0·9	
	1966	660,491	0·7	
U.S.S.R.	1958-60	1,560,000	0·0013	Batunin and Berlin (1963)

(c) It has been suggested that the wide use and abuse of penicillin for medical conditions other than syphilis during the first 15 to 20 years of the penicillin era may have had a general "happenstance" preventive effect on incubating syphilis in exposed persons among the population at large (Schamberg, 1963; Danehower and Schamberg, 1963). This may have contributed to the observed sharp decline in early syphilis from 1948-50 to 1956-7. Conversely, the diminishing of this preventive effect may have been one of the causes of the recrudescence of syphilis. It has been shown that the penicillin doses resulting in such happenstance effect would suffice to abort most cases during the incubation period (Magnuson, Eagle, and Fleischman, 1948). Although the absolute production of penicillin has increased since 1955 in the U.S.A. (Table V) and there has been a relatively much greater increase in the production and use of non-treponemoidal broad-spectrum antibiotics since 1960 in Great Britain, it is also probable that the use of penicillin has become more selective since 1956-7.

TABLE V
ANTIBIOTICS PRODUCTION IN THE UNITED STATES
1951-1965 (excluding feed supplements)*

Five-Year Periods	Penicillin		All Other Antibiotics		Total
	Thousands of lb.	Percentage	Thousands of lb.	Percentage	
1951-55	3,135	40.6	4,373	59.4	7,508
1956-60	3,164	29.4	7,559	70.6	10,723
1961-65	7,228	29.9	16,909	70.1	24,137
Total	13,527	—	28,841	—	42,368

*United States Department of Health, Education, and Welfare (1967). Communication from the Food and Drug Administration (February, 1967).

(d) Since the end of the 19th and at the beginning of the 20th century, Nordic public health laws have provided for special activities against venereal diseases. In Great Britain the Public Health Act of 1916, required free examination and treatment facilities for venereal disease (Royal Commission, 1916). Similar measures followed in many European and some overseas countries, including the United States. The International Union against the Venereal Diseases and the Treponematoses (IUVDT) was instrumental in obtaining the introduction of such measures. Apparently, public health activities affected the frequency of venereal disease in many countries at about the same time, regardless of the differences of methods used (Willcox, 1964). Subsequently, the high venereal

disease incidence during and immediately after the second world war led to some further strengthening of public health control measures and their modernization, *e.g.* the Rapid Treatment Centre programme in the U.S.A.

The impressive early therapeutic achievements of penicillin apparently lured health administrations as well as the public into indifference to control measures, although venereal diseases were obviously not "dying diseases" (King, 1958). It is only recently that some re-orientation in the public health aspects of syphilis control has become discernible in some few countries, where the rise in early syphilis has reactivated health administrations. It is reasonable to suggest that, for example, the marked fall in 1965 in France—which continued also in 1966—and the levelling off in the U.S.A. are initial results of intensified control programmes (Vernier, 1965; USPHS, 1963).

(e) In many countries the ambulatory treatment of syphilis with penicillin has been taken over to a great extent by private practitioners (Curtis, 1963; Degos and Delzant, 1963), who cannot easily manage modern complicated and time-consuming control activities. In the opinion of many authorities, the failure of epidemiological co-operation between private doctors and public health authorities has become an important element in the upsurge of syphilis since the mid-fifties in some countries.

Economic, Social, and Behavioural Changes

(a) We have already indicated the association between war and the periodic recurrence of early syphilis. Casual links between periods of expanding economy and the spread of syphilis have also been pointed out, particularly by Haustein (1927b) in the 1920s and by Gjessing (1956) in more recent years. There is no contradiction between these aspects, since a war economy is usually of an inflationary nature leading to temporary economic affluence and lavish spending. On the other hand, the global rise in the incidence of early syphilis since 1956-7 started in peace-time, and the post-war cycle of fall—and rise—has covered an almost unbroken period of economic expansion. It is logical—and notable—that during the first part of the post-war period individual and collective investments of money in most parts of the world were used for resettlement, reconstruction, and rehabilitation. But in recent years funds have increasingly been used for "consumer" goods, combined to an amazing extent

with travel, tourism, and entertainment, all of importance in the epidemiology of syphilis. Obviously, in addition to the economic forces, other factors also influence the treponeme-host balance in man.

(b) Changing ethical, moral, and behavioural codes in the post-war years have been associated with increased sexual activity (*Time*, 1964; B.M.A., 1964). But we must remember that so-called morality has undergone great variations also in the past. To-day, however, because of rapid social, economic, and technical progress, such changes infiltrate society almost explosively. In this context several aspects must be considered:

(i) *Changing Patterns of Prostitution* Hecht (1927) in 1922 considered that prostitution stemmed to a great extent from poverty and lack of daily needs. Licensed or supervised prostitution was legal, often confined to brothels, with clandestine prostitution often reported to have exceeded legal prostitution. In Western Europe and North America before the second world war prostitution was thus regarded as the main single source of syphilitic infection in males.

Following the improvements of socio-economic conditions, industrialization, female emancipation, expanding civil rights, etc., the general pattern of prostitution has changed in developed countries. Traffic in women and children, legalized controlled prostitution, etc., have in principle been abolished by international action (United Nations), and legalized prostitution and brothels have since almost ceased to be reported as a major source of venereal infection (Willcox, 1956). During the post-war reconstruction period, prostitution continued to be optimistically viewed as of minor epidemiological importance. There is, however, evidence that the problem has reappeared in a modified form along with economic affluence. Women in developed countries are rarely driven to the sale of sex to obtain the basic necessities of life—as was previously often the case. They are rather driven by the urge to obtain the extra luxuries and consumer goods held out as essential by a sex-conscious advertising industry, articles which are often beyond their normal social and economic possibilities (French, 1955). Furthermore, mental deviations, hereditary factors, ethnic and group minority traits, inadequate family, social, and educational background, alcohol and drug addiction (Ducrey, 1960; Mayer, 1962; Brandão, da Cruz Sobral, and da Fonseca, 1965) cause mal-

adjustment to society and failure to overcome the complexities of modern life, and lead to promiscuous behaviour patterns. Some data on syphilis and prostitution from six countries are shown in Table VI (overleaf).

There is a trend towards an increase of prostitutes in the new sense as sources of infection, while “bread-and-butter” prostitution remains in developing countries. An extreme contrast is offered by the remarkable pilot project in several cities in West Germany to organize “Eros Centres” with complete vanity and sexual services by registered unmarried females, based on a ruling of the West German High Court that immoral earnings should be considered as a basis for fiscal taxation (Terry, 1967).

(ii) *Homosexual Males* In the mid-twenties homosexual practices were considered subordinate as a source of syphilis infection (Hecht, 1927), but attention has recently been called to the increasing role of male homosexuals in the epidemiology of venereal diseases. Table VII (overleaf) summarizes information from several countries. Homosexual contacts were reported to range from about 10 to more than 90 per cent. in selected studies. The problem is particularly one of big cities, where young male homosexual prostitutes congregate (Hooker, 1962; Tarr, 1962). They frequently have heterosexual contacts also (Eck, 1966) which adds to their importance in the spread of infection.

(iii) *Young People* In the U.S.A. the age-specific rate per 10,000 population of cases of primary and secondary syphilis in young people increased from 10.1 in 1956 to 24.2 in 1965 compared with a rate of 11.6 for all age groups (American Social Health Association, 1967). A similar trend has been reported by the Canadian Department of National Health and Welfare (Canada, 1965), West Germany (1965), the Netherlands (1965), Italy (Coffari, 1965), and Scandinavia (Danbolt, 1966; Ekström, 1964; Hellerström, Ruhnek-Forsbeck, Hederstedt, and Palme, 1964). It is not possible from the limited data to appraise any long-term trends in syphilis, but comparable data are available for Sweden for the years 1925, 1939, and 1964 (Sweden, 1964); the incidence was about the same in 1925 and in 1939, but almost trebled in 1964. In Sweden, Finland, and France in 1964–5 the incidence of syphilis was higher in females than in males in the teenage group—as was the case in Sweden in 1925. These findings are similar to those given by Haustein (1927b) in his statistical review of syphilis in the

TABLE VI
PROSTITUTION AND INFECTIOUS SYPHILIS

Country	Year	Recent Information on Syphilis among Prostitutes	Source
France	1949	Licensed prostitution abolished	Godlewski and Godlewski (1963) Pellegrin (1966)
	1959	16 per cent. of infectious syphilis contracted from prostitutes	
	1964	38 per cent. of infectious syphilis contracted from prostitutes	
	1965	30 to 40 per cent. of syphilis in males estimated to have been contracted from paid prostitutes	
Germany	1964	Morbidity rate of venereal infections among prostitutes probably fifty to one hundred times higher than in the population as a whole	Proppe and Wagner (1965)
Italy	1958	Licensed prostitution abolished	Ducrey (1964)
	1964	Prostitution the most important source of venereal infections	
Japan	1950	Anti-prostitution law enacted	Tanami and Yamamoto (1958)
	1958	Prostitutes the source of 70 per cent. of venereal disease, and the most important factor in its spread	
Lebanon	1965	Of 175 street-walkers, 57 per cent. had venereal disease Among 475 foreign cabaret girls the percentage was somewhat higher	Lebanon: Ministry of Health (1965)
Portugal	1958	Of 179 prostitutes, 5.5 per cent. had infectious syphilis	da Cruz Sobral, Maciel Chaves, Roda, and Meneres Sampaio (1965)
	1964	Of 200 prostitutes, 26.5 per cent. had infectious syphilis Prostitution one of the most important factors in the spread of venereal disease	
Thailand	1965	Of 352 males 30 per cent. named prostitutes as source of infection Sero-positivity among prostitutes about 30 per cent. Sero-positivity among pregnant women 5.6 per cent. Prostitutes the main source of venereal infection	Suthisomboon (1965)
United Kingdom	1959	0.6 per cent. of 1,921 female prisoners had early syphilis 2.6 per cent. of 415 prostitute prisoners had early syphilis	Keighley (1960)
United States of America	1964	4.7 per cent. of 5,444 males (14 states) with infectious syphilis named prostitutes as contacts	American Social Health Association (1967)
	1966	16.5 per cent. of 583 males (12 states) with infectious syphilis named prostitutes as contacts	

first quarter of the 20th century, so that the changes have been quantitative rather than qualitative.

Population Movements

The international aspects of venereal disease control have been emphasized in relation to population movements by many investigators, most recently by Nicol (1964).

(a) Several investigations have been made of the potential spread of venereal diseases by migrant labourers. The part played by West Indian immigrants into the United Kingdom has been well documented (British Cooperative Clinical Group, 1960, 1965; Willcox, 1963). In West Germany and Switzerland there are extensive foreign labour forces (respectively 1.2 and 0.7 millions) who have been found not to contribute much to the importation and spread of disease in the host countries (Lundt, 1963; Switzerland, 1966). Thus the sero-reactivity rates 1957-63 in the West German imported labour force was 0.22 per cent. compared to 0.20 per cent.

in the home population, and in Switzerland in 1963 0.09 per cent. as against 0.03-0.04 per cent. among blood donors in the general population. In France, however, the rate among foreign labourers increased from 1.4 per cent. in 1958 to 2.9 per cent. in 1964, owing to an influx of labour from North African countries (Vernier, 1965). Measures have been taken which may be responsible for the apparent downward trend in reported early syphilis in France in 1965 and which has continued in 1966, as already mentioned. Data from West Germany, France, and Switzerland are summarized in Table VIII (opposite).

(b) In recent years the incidence of syphilis and other genital infections has increased in urban and industrial areas in many countries (Degos, 1960). 6 per cent. of the population of the U.S.A. lived in cities in 1880 compared with some 70 per cent. in 1960 (Revelle, 1966). In 1966, 59 cities (21.8 per cent. of the population of the U.S.A.) accounted for 53.8 per cent. of the total reported cases of primary and secondary syphilis (American Social Health

TABLE VII
HOMOSEXUALS AND INFECTIOUS SYPHILIS

Country	Year	Number of Males Diagnosed with Infectious Syphilis	Male Contacts Named		Source
			No.	Percentage	
Bulgaria	1965	157	—	23·4	Kirjakov, Boner, and Spirov (1966)
Canada	1957-61	193	180	93·5	Hooker (1962)
Denmark	1961	52	13	25·0	Schmidt, Hauge, and Schønning (1963)
	1963	72	37	52·0	Kvorning (1963)
France	1963	—	—	20·0	Texier (1963)
Netherlands	1963	378	—	11·0	Netherlands (1966)
Sweden	1963	37	14	37·8	Hellerström, Ruhnke-Forsbeck, Hederstedt, and Palme (1964)
Switzerland	1965	39 syphilitics found among 217 homosexuals examined	—	18·0	Switzerland (1966)
			—	10·5	
United Kingdom	1956	—	—	8·4	Jefferiss (1956)
	1965	—	—	14·8	Fluker (1966)
United States of America	1962	159	89	56·0	Tarr (1962)
	1965	5,534*	1,388	25·1	American Social Health Association (1967)
	1966	5,811*	1,261	21·7	
Ceylon	1965	Male homosexual sources accounted for 23·9 per cent. of male syphilis			Ceylon (1964-5)

*In 45 cities of over 200,000 population.

TABLE VIII
RESULT OF SEROLOGICAL TESTS FOR SYPHILIS OF FOREIGN LABOUR AND OF SELECTED POPULATION GROUPS IN THREE COUNTRIES

Country	Year	Foreign labourers Examined	Percentage Foreign Syphilitics (serological or clinical)	Percentages Serological Reactors in Selected National Population	Source
West Germany	1957-63	561,790	0·22	0·20 Estimated	Lundt (1963)
Switzerland	1950	42,895	0·43		Switzerland (1966)
	1960	278,671	0·06		
	1963	209,743	0·09	0·04 among 95,000 blood donors	
France	1958	11,515	1·4	0·3	France (1966)
	1960	12,534	2·1	0·3	
	1963	23,143	2·4	0·3	
	1965	32,494	2·9	0·4 Pre-marital examinations	

Association, 1967). Epidemic outbreaks of venereal infection have been reported in several countries following the implantation of large industrial complexes into rural areas (*e.g.* in Odense in Denmark: Perdrup, 1966). On the other hand, the venereal disease problem of rapidly growing industrial settlements can be checked when adequate environmental, health, and education programmes are set up from the beginning. This has been shown

by Capinski (1966) in Poland, where the infectious syphilis rate per 1,000 fell from 1·70 to 0·38 in the Nova Hota area during the first 10 years, despite a significant increase in population.

(c) The present floating population in overseas trade is estimated not to exceed a million seafarers. European countries account for the bulk of the 100 per cent. increase in the merchant fleets of the world

between 1945 and 1963, but an impressive growth has taken place in African and Asian countries also (Table IX), indicating that better international co-operation in the maritime health service and venereal disease control is required than was foreseen when the International Brussels Agreement of 1924 was revised by WHO in 1960. Several investigators have reported the increasing importance of venereal disease in seafarers (Härö and Pätälä, 1961; Schofield, 1965; Hartmann, 1956; Idsøe and Guthe,

1963). In Finland in 1961 more than half of the infections in seafarers had been acquired abroad (Schofield, 1965). The same applied to Danish seafarers in Copenhagen (Hartmann, 1956). In an English seaport 60 per cent. of seafarers treated had become infected abroad, eleven different countries being named (Schofield, 1965). Of 4,066 sailors of thirty nationalities treated in 1960-4 in French ports, 64.5 per cent. had become infected in non-French ports (France, 1967). Table X gives further data (WHO, 1966).

TABLE IX
MERCHANT SHIPPING FLEET*
(thousand gross registered tons)

Area	Year	
	1945	1963
Africa	252	18,301
Asia	2,599	19,171
Americas	36,184	32,374
Europe	37,655	80,501
World Total	76,690	150,347

*United Nations Statistical Yearbook (1965).

(d) The combination of economic affluence and peace-time tourism for the masses has to a large extent replaced the epidemiological element previously represented by movements of armed forces. The year 1967 has been declared "International Year of Tourism" and a further rise is expected in this very great industry of modern times (Table XI, opposite).

Only sporadic direct documentation is available on the prevalence and spread of infection among tourists and travellers. In Sweden, 24 per cent. of

TABLE X
VENEREAL DISEASE DIAGNOSED IN WORLD PORTS IN SEAFARERS FROM VARIOUS HOME COUNTRIES,
BY WHO REGIONS*

Year	Country or Port of Diagnosis	Total VD Diagnosed among Seafarers	Home Countries of Seafarers	
			Region	No. of Countries
1962-5	Colombo	407	African American European E. Mediterranean S. E. Asian W. Pacific	1 3 14 2 2 5
1965	Kuwait	548	European E. Mediterranean S. E. Asian	10 1 1
1965	Singapore	154	European S. E. Asian W. Pacific	Not specified 1 2
1960-3	Haifa	76	American European E. Mediterranean	1 5 3
1965	Polish ports	99	European	11
1957-61	Leningrad	70	American European E. Mediterranean	15
	Black Sea ports		Not specified	
6 months 1966	Buenos Aires	146	European	6
6 months 1966	Yugoslav ports	251	American European E. Mediterranean S. E. Asian	2 13 2 1
1965	Finnish ports	377	American European	1 9

*WHO unpublished Study on Seafarers (1966).

TABLE XI

EXTENT OF INTERNATIONAL TOURISM, 1958-1966
ARRIVALS OF TOURISTS IN 26 COUNTRIES AND
ESTIMATED ECONOMIC VALUE*

Year	Arrivals	Indices	Receipts (\$ million)	Indices
1958	55,250,000	100	5,449	100
1959	63,000,000	114	5,847	107
1960	71,138,674	129	6,842	126
1961	75,281,000	136	7,284	134
1962	81,406,000	147	8,027	147
1963	93,756,000	170	8,834	162
1964	107,744,447	195	10,159.1	186
1965	115,892,595	210	11,633.5	213
1966	127,990,000	232	12,997.0	239

*Tourism: International Bureau, Geneva (1967).

patients with early syphilis acquired their infection abroad; in the United Kingdom it was estimated that 40 per cent. of male patients were infected abroad (British Cooperative Clinical Group, 1960). Moreover, examples from Ceylon (1964-5) and West Germany (Memmesheimer, 1964) illustrate the spread of venereal infections at exhibitions and fairs. The epidemiological effect of tourism as a whole is also documented in case/contact histories obtained from several countries (Table XII).

Population Control

Millions of women are now using anticonceptual devices and pills. Behavioural research has shown that their use increases sexual activity and multiplies sexual contacts (Juhlin, 1967), but while they may prevent conception they do not prevent the transmission of venereal disease. It follows that this new element in our rapidly changing environment may well increase the spread of genital infections in the future. It is therefore suggested that those working in the population control field should co-operate with those concerned with communicable diseases.

Consideration might also be given to a broader approach in terms of *genital infections*, or *sexually transmitted diseases*, regardless of aetiology, rather than of *venereal diseases*, as traditionally limited by legal definition.

Summary

The evolutionary aspects of the treponematoses, the ecological changes, and the long-term rise and fall of syphilis, yaws, and pinta have been appraised.

In the present study (Part I) attention is focused on trends in venereal syphilis. A general regression of early, late, and congenital disease is evident in the last hundred years, notwithstanding important recurrences associated with wars and socio-economic upheavals. Improvements in diagnosis, the introduction of metal therapy and antibiotics, the volume of susceptibles available for infection at any one given time, public health laws and their implementation, the co-operative aspects of control programmes with private doctors, etc., are assessed in relation to long-term trends and periodic recrudescences.

The recurrence of early syphilis during the second world war, the subsequent rapid regression of this epidemic, and the renewed recrudescence since 1956-7 in most parts of the world are appraised in relation to the rapid ecological changes which have taken place in the last two decennia. Changing ethical, moral, and behavioural codes have been associated with increased sexual activity. The changing pattern of prostitution is described in some detail; the spread of syphilis by male homosexuals is considered; and the evidence available on the role of young people in the spread of syphilis is reviewed.

International factors in the spread of syphilis are documented in relation to population movements,

TABLE XII
TOURISM AND VENEREAL DISEASES

Year	Country	New Infections with Syphilis	Source
1964	Canada	Exchanged 400 contact informations with foreign countries	Canada (1964)
1958	Ten European Countries	Exchanged 231 contact informations	WHO (1963)
1962		Exchanged 1,468 contact informations	
1964	Ceylon	Sharp increase of infectious syphilis cases following international exhibition in Colombo, Ceylon	Ceylon (1964-5)
1964	Sweden	24 per cent. total syphilis infections acquired abroad 22 per cent. males infected abroad	Sweden (1964)
1956	United Kingdom	40 per cent. of all males with venereal disease acquired infection abroad	British Cooperative Clinical Group (1965)
1964	United States of America	Sent 2,285 contact information to 52 different foreign countries	Garson (1965)
1960	West Germany	Sharp increase in infectious syphilis cases after an international exhibition in Dortmund, Germany	Memmesheimer (1964)

migration of labour, urbanization and industrialization, maritime activity, and international tourism, all of which have assumed unprecedented proportions in recent years.

Population control and the increasing use of contraceptives permit increased sexual activity and influence behavioural patterns. This aspect may become an important epidemiological factor in the future.

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L'augmentation et la diminution des cas de Tréponematoses.

I. Aspects écologiques des tendances internationales de la syphilis vénérienne

RÉSUMÉ

Les aspects de l'évolution des tréponematoses, les changements écologiques, et l'augmentation et la diminution à long cours de la syphilis, du pian et du pinta ont été évalués.

Dans cette étude (Section I) l'attention est portée sur les tendances de la syphilis vénérienne. Une régression générale des formes précoces, tardives et congénitales de la maladie est évidente pendant les cent dernières années, malgré d'importantes recrudescences pendant les guerres ou les convulsions socioéconomiques. L'utilisation des améliorations diagnostiques et des antibiotiques, la thérapeutique à base de sels de métaux, le nombre de personnes susceptibles d'être infectées à n'importe quel moment, les lois d'hygiène et leur mise en vigueur, les aspects des différents plans de traitement faits conjointement avec les médecins de la clientèle, etc., sont évalués en relation des tendances à longs terms et des recrudescences périodiques.

Le retour de la syphilis précoce pendant la deuxième guerre mondiale, la régression accélérée qui a suivi cette épidémie et la recrudescence qui a eu lieu de nouveau depuis 1956-7 à travers le monde sont évalués en relation des changements écologiques rapides des vingt dernières années. Les changements qui ont eu lieu dans les codes de la morale et de la conduite ont été liés à un surcroît des plaisirs charnels. Les changements dans les méthodes employées par les prostituées sont décrits en quelque détail; la propagation de la syphilis par les pédérastes est incluse; et les renseignements disponibles apportés par la participation des jeunes à la propagation de la syphilis sont passés en revue.

Des renseignements au sujet de la propagation de la syphilis à l'échelle internationale sont donnés en prenant compte des mouvements de population, du déplacement des travailleurs, de l'urbanisation et de l'industrialisation, du mouvement maritime et du tourisme, tous ayant pris des proportions inouïes pendant ces dernières années.

La régulation de la population et l'usage croissant des contraceptifs ont permis une augmentation des relations sexuelles et ont influencé le mode de conduite. Cet aspect pourrait devenir à la longue un important facteur épidémiologique.

ANNEX 1

NOTIFIED CASES OF EARLY INFECTION.
RATE PER 100,000 FOR EACH YEAR

Region	Country	1950		1951		1952		1953		1954		1955		1956	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Africa	Angola	—	—	—	—	—	—	—	—	—	—	—	—	545	2.0
	Chad	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Madagascar	21,396	502.7	13,975	322.2	9,972	225.8	9,125	202.7	8,585	186.5	—	—	4,639	55.5
Americas	Argentina	1,143	6.7	1,043	6.0	3,768	21.1	1,955	10.7	1,782	9.6	2,057	10.9	2,545	33.2
	Canada	1,049	7.6	629	4.5	543	3.7	312	2.1	225	1.5	180	1.1	169	1.0
	Costa Rica	80	10.0	92	11.2	118	13.8	81	9.2	62	6.8	91	9.6	76	7.7
	El Salvador	3,815	205.2	3,462	181.1	3,450	175.6	2,346	116.1	2,161	104.0	1,893	88.7	1,724	88.5
	U.S.A.	32,148	21.1	18,211	11.8	11,991	7.6	9,551	6.0	7,688	4.7	6,516	3.9	6,757	4.0
Eastern Mediterranean	United Arab Republic	1,636	8.0	1,561	7.5	1,396	6.5	1,014	4.6	595	2.6	404	1.8	342	1.1
Europe	Denmark	743	17.4	441	6.0	214	4.9	149	3.4	114	2.6	119	2.7	104	2.2
	Finland	391	17.4	242	6.2	139	3.4	68	1.6	57	1.4	30	0.7	31	0.7
	France	2,703	6.5	1,998	4.7	1,874	4.4	1,282	3.0	1,222	2.8	1,156	2.7	1,452	3.1
	Italy	5,896	12.6	3,464	7.4	2,311	4.9	2,280	4.8	1,824	3.8	2,289	4.7	2,697	5.1
	Norway	701	21.5	477	14.5	306	9.2	307	9.1	222	6.5	206	6.0	127	3.1
	Poland	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Portugal	683	8.1	707	8.3	379	4.4	531	6.2	479	5.5	238	2.7	243	2.2
	Sweden	608	8.7	453	6.4	355	4.8	184	2.6	162	2.2	168	2.3	123	1.6
	United Kingdom (England and Wales)	4,143	9.4	2,272	5.2	1,353	3.1	1,074	2.4	808	1.8	837	1.9	844	1.1
South-East Asia	Ceylon	—	—	1,549	19.7	1,356	16.8	269	3.2	318	3.7	322	3.7	172	1.1
Western Pacific	Hong Kong	—	—	863	42.8	852	40.1	766	34.2	447	18.9	187	7.5	113	4.4
	Japan	52,403	63.2	27,404	32.5	16,728	19.6	10,440	12.0	8,119	9.2	6,740	7.6	5,810	6.6
	Laos	—	—	1,217	89.5	1,134	81.0	2,110	146.0	3,154	209.6	6,532	421.4	6,519	407.7

ANNEX 2

NOTIFIED CASES OF CONGENITAL INFECTION.
RATE PER 100,000 FOR EACH YEAR

Regions	Country	1950		1951		1952		1953		1954		1955		1956	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Africa	Madagascar	80,561	1892.9	60,661	1398.7	73,744	1669.5	83,459	1853.8	76,769	1667.8	—	—	—	—
Americas	Argentina	—	—	—	—	—	—	—	—	—	—	382	2.0	303	—
	El Salvador	429	23.1	705	36.9	324	16.5	199	9.9	138	6.6	144	6.7	173	—
	U.S.A.	13,446	9.0	12,836	8.5	9,240	6.1	8,021	5.2	7,334	4.6	5,515	3.4	5,535	—
Europe	Denmark	11	0.9	5	0.4	7	0.6	7	0.6	7	0.6	5	0.4	1	—
	United Kingdom (England and Wales)	1,223	12.7	1,127	11.7	949	9.8	844	8.7	886	9.0	644	6.4	590	—
	Norway	—	—	—	—	—	—	—	—	24	0.7	20	0.6	15	—
	Sweden	20	1.2	20	1.2	12	0.7	13	0.8	11	0.6	9	0.5	3	—
South-East Asia	Ceylon	74	1.0	39	0.5	118	1.5	31	0.4	112	1.3	81	0.9	59	—
Western Pacific	Hong Kong	—	—	213	10.6	124	5.8	113	5.0	117	4.9	130	5.2	83	—

SYPHILIS, NUMBER AND INCIDENCE
1950-65, BY WHO REGIONS

1957		1958		1959		1960		1961		1962		1963		1964		1965	
No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
258	5.6	349	7.5	501	10.6	429	8.9	587	12.0	512	10.4	655	13.1	631	12.4	600	11.6
—	—	16,379	542.4	8,133	265.8	7,227	232.4	8,759	277.2	9,839	307.5	9,018	277.5	—	—	—	—
3,907	78.1	2,000	39.0	3,670	70.0	8,548	158.5	3,821	68.6	3,109	54.0	2,765	46.5	2,214	35.8	—	—
1,984	10.1	1,596	8.0	1,975	9.7	4,606	22.3	1,501	7.1	—	—	1,572	7.2	1,315	6.0	—	—
192	1.2	205	1.2	389	2.2	461	2.6	587	3.2	783	4.2	845	4.5	817	4.2	621	3.2
61	5.9	140	13.0	127	11.3	201	17.2	249	20.3	473	37.1	391	29.1	382	27.5	—	—
1,330	58.9	1,735	74.8	2,463	103.2	2,699	110.0	800	31.7	1,522	57.9	2,058	75.6	5,346	189.3	2,663	90.3
6,251	3.6	6,661	3.8	8,178	4.6	16,144	8.9	19,851	10.8	21,067	11.3	22,251	11.7	22,968	12.0	23,250	11.9
356	1.5	395	1.6	363	1.4	273	1.1	245	0.9	257	0.9	206	0.7	94	0.3	—	—
50	1.1	55	1.2	94	2.1	217	4.7	493	10.7	460	9.9	431	9.2	414	8.8	488	10.3
21	0.5	29	0.7	17	0.4	20	0.4	33	0.7	26	0.6	87	1.9	262	5.7	407	8.8
1,348	3.1	1,461	3.3	1,837	4.1	2,502	5.5	3,608	7.8	4,551	9.8	4,749	9.9	5,336	11.0	4,539	9.3
2,710	5.6	3,228	6.6	4,443	9.0	6,404	12.9	8,065	16.2	5,436	—	4,209	—	3,888	—	3,744	—
116	3.3	98	2.8	111	3.1	103	2.9	92	2.5	123	3.4	152	4.1	202	5.5	258	6.9
—	—	5,360	18.6	4,976	17.0	4,741	16.0	4,980	16.6	4,596	15.0	4,552	14.8	4,142	13.3	5,358	17.1
197	2.2	176	2.0	154	1.7	163	1.8	131	1.5	128	1.4	127	1.4	92	1.0	216	2.3
88	1.2	73	1.0	93	1.2	87	1.2	120	1.6	241	3.2	312	4.1	484	6.3	476	6.2
747	1.7	518	1.1	561	1.2	797	1.7	935	2.0	1,203	2.6	1,390	2.9	1,395	2.9	1,738	3.7
165	1.8	184	2.0	205	2.1	198	2.0	149	1.5	86	0.8	—	—	310	2.8	471	4.2
24	0.9	12	0.4	28	0.9	66	2.1	61	1.9	180	5.3	224	6.2	183	5.0	—	—
4,440	4.9	2,116	2.3	1,280	1.4	910	1.0	884	0.9	1,217	1.3	1,287	1.3	—	—	—	—
—	—	3,492	204.2	6,114	347.4	2,958	163.9	8,699	470.2	1,846	98.2	3,149	164.0	—	—	—	—

SYPHILIS, NUMBER AND INCIDENCE
EAR 1950-65, BY WHO REGIONS

1957		1958		1959		1960		1961		1962		1963		1964		1965	
No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
1,328	26.5	509	9.9	23,477	447.6	18,246	338.3	12,644	226.9	9,089	157.9	7,872	132.5	3,816	61.7	—	—
339	1.7	199	1.0	317	1.6	338	1.6	117	0.6	—	—	88	0.4	104	0.5	—	—
107	4.7	73	3.1	103	4.3	89	3.6	63	2.5	97	3.7	100	3.7	102	3.6	—	—
5,452	3.3	4,839	2.8	5,215	3.0	4,593	2.6	4,388	2.4	4,085	2.2	4,140	2.2	3,737	2.0	3,505	1.9
1	0.08	—	0.0	2	0.2	1	0.08	10	0.2	2	0.04	3	0.06	8	0.2	10	0.2
557	5.5	437	4.3	372	3.5	366	3.5	340	0.7	312	0.7	362	0.8	258	0.5	275	0.6
14	0.4	14	0.4	10	0.3	12	0.3	10	0.3	19	0.5	7	0.2	13	0.4	8	0.2
9	0.5	3	0.1	3	0.1	1	0.01	—	—	2	0.03	4	0.05	2	0.03	5	0.06
34	0.4	45	0.5	65	0.7	74	0.7	—	—	86	0.8	—	—	71	0.6	—	—
119	4.3	93	3.3	141	4.8	74	2.4	51	1.6	77	2.3	58	1.6	48	1.3	—	—