SCIENCE

FRIDAY, OCTOBER 3, 1919

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EPIDEMIOLOGY AND RECENT EPIDEMICS[1]

IT has been the custom, I am informed, at these meetings to spend little time and few words on mere felicitations, but to proceed as promptly as may be to the business of the congress. However, you will, I know, indulge me long enough to enable me to express to you in some degree the sense of honor and responsibility which I feel on this occasion.

Since the last congress, which was held in 1916, in the midst of the racking uncertainties of the great war, notable events and serious calamities have befallen the world and arrested the attention of all thoughtful men. A bitter and passionate military contest has been brought to a hopeful conclusion; but because of the unparalleled cost of the struggle, in lives and in treasure, deep unrest, revolution even, starvation and diseases are prevailing over a large part of Europe, while also within the three-year period elapsed between the last congress and the present one three destructive epidemics of disease have ravaged the United States and the world.

Hence it has seemed fitting to me that on this occasion and before this representative body of medical men we should pause for a brief period in order to review, as it were, our knowledge of epidemics and at the same time of the practical hygienic measures, based on this knowledge, which we already put or in ordinary course of events may reasonably hope to put into motion against the spread of these epidemics, so that we may form a judgment of the efficacy of such measures and arrive possibly at new points of view from which to launch a more decisive attack. Moreover, it

[1] President's address, X. Congress of American Physicians and Surgeons, held at Atlantic City, N. J., June 16 and 17, 1918. This address appears in the *Journal of the American Medical Association.*

seems imperative that we should consider not only the sum of our knowledge of epidemics, but also certain facts relating to the population affected, which react powerfully on the successful application of the hygienic means available.

Three epidemic diseases, poliomyelitis, streptococcus pneumonia and influenza, have been especially destructive in the western world during the past three years; also, because of certain common characteristics, they are well adapted for the purpose I have in view.

In the United States we are becoming increasingly familiar with epidemics of poliomyelitis. Prior to 1907 infantile paralysis was a rare disease in this country; since then it has prevailed fitfully every summer and autumn, and in one notable instance, at least, in the winter season,[2] claiming victims by the score or hundred, until in 1916 an outbreak of unprecedented severity, with its center of violence in New York state, swept over a considerable number of states.

Fundamental knowledge of poliomyelitis may be said to have grown rapidly since Wickman's epochal clinical studies published in 1907. We are indeed to-day in possession of precise information covering essential data with regard to the nature of the inciting microorganism, notwithstanding its very minute size, and also concerning the manner in which it leaves the infected or contaminated body within the secretions of the nasopharynx chiefly and gains access to another human being by means of the corresponding mucous membranes and apparently no other way. Moreover, the inciting virus so called, up to the present time and notwithstanding many and assiduous efforts, has not been detected apart from the infected or merely contaminated human being, and there is therefore no foundation in ascertained fact for an assumption that the virus is conveyed to persons otherwise than by other persons who harbor it.

The second example, namely, that of streptococcus pneumonia, presents a phenomenon almost, if not quite, new among the epidemic diseases. It appears as if during the winter of 1917–1918 there occurred in several localities within the United States and also, but in less degree, in France, at least a great increase in the incidence of a type of pneumonia which previously had been very infrequent. It appears also that the greatest number of cases and of fatalities arose in the United States in the military cantonments; that the disease first prevailed as a secondary pneumonia following measles; but that before long the severity of the infection was such that cases of primary streptococcus pneumonia began to arise. Moreover, at this juncture the disease spread from the military to the civil populations.

The nature of the microorganism inducing this form of epidemic pneumonia is indicated in the name which the disease has come to bear. The difficulty in this instance has not been in finding out the inciting microbe, but rather in differentiating the streptococci responsible for the epidemic disease from streptococci possessing the ordinary pathogenic properties, or even from those of saprophytic nature so commonly present on the upper respiratory mucous membranes without provoking widespread disease. However, numerous studies of the bacteriology of this epidemic of pneumonia, at distinct and often widely remote cantonments, showed that the microbic incitant was in almost every instance *Streptococcus hemolyticus*. Moreover, because of the wide occurrence of the epidemic pneumonia, this type of streptococcus could be found in normal throats and as a secondary invading microorganism in the lungs in cases of ordinary lobar pneumonia. Thus far very little progress has been made in the classification of streptococci, which form a class apparently even more heterogeneous than the pneumococci.

The point I wish to emphasize is this: Regarding epidemic diseases in general we are wont to assume the introduction from without and usually from a distant locality of a special kind or race of microorganism which is held directly responsible for the epidemic ensuing. In the instance of the epidemic pneumonia no such importation or new introduction of the inciting streptococcus needs to be or actually is assumed. It is so

[2] Fairmont, West Virginia.

probable as to amount to practical certainty that the excessively virulent *Streptococcus hemolyticus* was developed by a process of selection, through successive transfer from person to person, and by gradual enhancement of its invasive properties.

We are in this case on safe grounds when we assert that the inciting streptococcus is always personally borne: that is, that it leaves the respiratory organs of one person to be introduced upon the corresponding organs of other persons, and in no other manner. In other words, the mechanism or mode of infection in epidemic streptococcus pneumonia, as in poliomyelitis, may be said to be clearly apprehended.

The case of influenza, the third and perhaps the most important example cited, is quite different, since wide divergences of belief and opinion regarding the nature of the inciting microorganism and the manner of infection still prevail. The reasons for these differences are several, but the most important perhaps relate to the common observation of the manner of spread or attack of the disease. To the casual observer there is something uncanny in the way influenza strikes down its victims. While other epidemics proceed from bad to worse, with at least progressive increases in intensity, influenza seems to overwhelm communities over even wide stretches of territory as by a single stupendous blow. While in the one case the gradually accelerating rate of speed of extension may be taken to indicate personal conveyance of the provoking microorganism, in the other case the sudden wide onset appears to be the very negation of personal communication.

Hence the invoking of mysterious influences, the revival of the notion of miasm and similar agencies, to account for this phenomenon. Indeed, the public mind in general lends itself readily to such formless concepts, for the reason that there still resides in the mass of the people, even in the more enlightened countries, a large uneradicated residue of superstition regarding disease. One does not need to look far or dig deep in order to uncover the source of this superstition. We have only recently emerged from a past in which knowledge of the origin of disease was scant, and such views as were commonly held and exploited were mostly fallacious. It is indeed very recently, if the transformation can be said to be perfect even now, that the medical profession as a whole has been completely emancipated. All this is very far from being a matter of remote importance only, since in the end the successful imposition of sanitary regulations involves wide cooperation, and until the majority of individuals composing a community is brought to a fair level of understanding of and belief in the measures proposed serious and sustained endeavor to enforce them is scarcely to be expected.

And yet no better instance of a communicable disease could perhaps be invoked than influenza to exorcise the false idea of the mysterious origin of epidemics. To dwell solely on the sudden and overwhelming stroke of the disease is wholly to overlook the significant incidents that precede the mass infection, because they are of such ordinary nature and lack all dramatic quality. Accurate observers noted long ago that influenza in its epidemic form did not constitute an exception to the common rule governing epidemic diseases which were obviously associated with persons and their migrations. What the early students made out by tracing the epidemic backward to its point of departure more modern observers have confirmed by carefully kept records, often graphically compiled, as in the excellent instance of the Munich records covering the epidemic of 1889–92, which can now be supplemented by a number of similarly constructed records of the epidemic just passed. These detailed records show convincingly a period of invasion during which there is a gradual rise in the number of cases, to culminate, within a period variously estimated at from one to three weeks, in a widespread so called "explosive" outbreak of the disease.

It happens that the early cases of epidemic influenza tend not to be severe, chiefly because they rarely are attended by pneumonia and hence are frequently mistaken; and the confusion in diagnosis is resolved only when the

full intensity of the epidemic is realized. In the meantime rich opportunity has been afforded for the free and unrestricted commingling of the sick and the well, of doubtless healthy carriers of the inciting agent and others, until so high a degree of dissemination of the provoking microorganism has been secured as to expose the entire susceptible element of the population, which happens to be large, to an almost simultaneous response to the effects of the infecting microbe.

Deductions of like import can be drawn from the geographical movements of influenza epidemics. In eastern Russia and Turkestan influenza spreads with the pace of a caravan, in Europe and America with the speed of an express train, and in the world at large with the rapidity of an ocean liner; and if one project forwards the outcome of the means of intercommunication of the near future we may predict that the next pandemic, should one arise, will extend with the swiftness of the airship. Moreover, not only is this rate of spread determined by the nature of the transportation facilities of the region or the era, but towns and villages, mainland and island, are invaded early or late or preserved entirely from attack according as they lie within or without the avenues of approach or are protected by inaccessibility, as in instances of remote mountain settlements and of islands distant from the ocean lanes or frozen in during winter periods.

It is desirable, in the interest of clear thinking, to carry this consideration of the characteristics of epidemic influenza a step further. A feature of the epidemic disease of particular significance is the tendency to recur, that is, to return to a stricken region after an interval, usually of months, of relative quiescence. Thus the beginnings of the last pandemic in western Europe and the United States have been traced to sporadic cases appearing in April, May and June, possibly earlier even in certain places, while the destructive epidemic raged during September, October and November of 1918. There are very good reasons for believing that in itself influenza is not a serious disease, but that its sinister character is given by the remarkable frequency with which it is followed, under particular circumstances, by a concomitant or secondary pneumonic infection to which the severe effects and high mortality are traceable. Now it is this high incidence of pneumonia, the product of invasion of the respiratory organs with bacteria commonly present on the upper respiratory mucous membranes—streptococci, pneumococci, staphyloccocci, Pfeiffer's bacilli, and even meningococci—that stamp the recurrent waves of the epidemic with its bad name.

If we compare the pneumonic complications of influenza with those which arose in the cantonments in 1917–18, first as attendants of measles and later as an independent infection, we note immediately that in both instances the severe effects and high fatalities arose, not from bacteria brought or imposed from without, but from their representatives which are commonly resident upon the membranes of the nose and throat in health. Whatever we may have to learn of the microorganism inducing measles, still undiscovered, and of influenza, still under dispute, and their mode of invasion of the body, no one would question that the bacteria inducing pneumonia are personally borne.

With these various considerations before us we may now discuss the question of the efficiency of our public health measures in diminishing the incidence of epidemic diseases. It should now be evident that our three examples are essentially instances of respiratory infections, that is, diseases in which the inciting microorganism enters the body by way of the air passages, although not necessarily, as in poliomyelitis, directly injuring those parts. Protection in diseases of this class is not to be secured by applying sanitary measures on a wide scale to an extraneous and inanimate source of the infectious microorganism, as to water supplies contaminated with the dejecta of typhoid patients, or even to inferior animal species, such as the mosquito or the rat, which act as intermediaries in conveying the germs of yellow fever or of infectious jaundice; but it is alone to be attained by methods of personal

hygiene, applied on the individual scale of safeguarding one person from another, the most difficult of all hygienic regulations to enforce.

Returning now to epidemic poliomyelitis, we may fairly claim that we are in possession of the essential facts which, if widely applicable, should enable us to control the spread of that disease. But we can, I think, hardly claim that up to the present time our accomplishments in that direction have been remarkable. It is sufficient merely to compare the curve of incidence of the Swedish epidemic of 1905, before the nature and mode of infection of poliomyelitis were known, with those of the last several years in Massachusetts and New York state for example, in order to conclude that the progress of the epidemics in the several places was practically identical.

And, indeed, this is what might be expected in view of the difficulties surrounding the prompt and accurate diagnosis of poliomyelitis in its atypical and abortive, often ambulant forms. Once the disease is introduced under conditions favoring its epidemic spread a wide dissemination of the inciting microorganism takes place, and a constantly increasing number of persons becomes exposed to its presence, before any restrictive measures are put into effect, and indeed also after they have been applied. In the case of poliomyelitis, as in that of influenza itself, a wide distribution of the infectious agent precedes the enforcement of preventive sanitary regulations. These considerations do not, of course, warrant intermission of the protective measures now in use, which undoubtedly save many individuals from exposure and thus from potential attack; they do, however, offer an explanation of why, up to the present time, greater success has not attended efforts at control once the epidemic is under full way.

The case with the epidemic pneumonias is of another order. They represent theoretically two diseases which should respond to methods of control based upon our knowledge of their mode of infection. In the epidemic streptococcus pneumonia and the pneumonia following influenza we are dealing with pathological conditions in which not a newly introduced, extraneous microorganism is operating widely and insidiously, but in which the active microbes concerned are examples merely of intensified races of common and almost omnipresent species belonging to the flora of the nasopharynx. The infectious agents in these instances are contained within the nasal, buccal and bronchial secretions, and are disseminated in the sprayed material which is coughed or otherwise thrown into the surroundings of the patients. The lesson therefore to be derived from the severe experience of the recent pneumonia epidemics is to the effect that measles and influenza patients are not to be assembled into large groups or kept in open wards, but should be placed in separate rooms or cubicles, where they and their attendants may be preserved as far as possible from sputum droplet contamination. In the instance of epidemic pneumonia a chain of direct infection from one patient to another tends to be established, and hence the sanitary control of those diseases is to be sought through the breaking, as it were, of this vicious circle.

A distinction has now been intimated in the possibilities of direct sanitary control between the two epidemic diseases—namely, poliomyelitis and influenza—introduced from without, and the pneumonias, which are mere, if intense, exaggerations of sporadic diseases ordinarily prevailing. I propose now to lay before you a suggestion as to means of attacking the exotic epidemic diseases which may come to merit serious attention.

Epidemic diseases in the commonly accepted sense have fixed locations—the so-called endemic homes of the diseases. In those homes they survive without usually attracting special attention over often long periods of time. But from time to time, and for reasons not entirely clear, these dormant foci of the epidemics take on an unwonted activity, the evidence of which is the more frequent appearance of cases of the particular disease among the native population and sooner or later an extension of the disease beyond its endemic confines. Thus there are excellent reasons for believing that an endemic focus of

poliomyelitis has been established in northwestern Europe from which the recent epidemic waves have emanated.

Similarly, there are excellent reasons for regarding the endemic home of influenza to be eastern Europe and in particular the border region between Russia and Turkestan. Many recorded epidemics have been shown more or less clearly to emanate from that area, while the epidemics of recent history have been traced there with a high degree of conclusiveness. From this eastern home, at intervals usually of two or three decades, a migrating epidemic influenza begins, moving eastward and westward, with the greater velocity in the latter direction.

Now since the combating of these two epidemic diseases, when they become widely and severely pandemical, is attended with such very great difficulty and is of such dubious success, and this notwithstanding the prodigious public contests which are waged against them in which the advantages are all in favor of the invading microorganismal hosts, it would seem as if an effort of central rather than peripheral control might be worth discussing. According to this proposal, an effort at control amounting even to eventual eradication of the diseases in the regions of their endemic survival would be undertaken, an effort indeed not occasional and intensively spasmodic. as during the pandemical excursions, but continuous over relatively long periods, in the hope that the seed beds, as it were, of the diseases might be destroyed.

That such an effort at the eradication of a serious epidemic disease may be carried through successfully the experience with yellow fever abundantly proves. In attacking that disease the combat was not put off until its epidemic spread had begun and until new territory such as New Orleans, Jacksonville, Memphis, etc., had been invaded, but the attack was made on its sources at Havana, Panama and now Guayaquil, to which endemic points the extension into new and neutral territory has been traced.

I do not disregard the essential fact in bringing this suggestion forward, that the control at its sources of yellow fever is quite another and probably far simpler problem than the control in their endemic foci of poliomyelitis and influenza. It is perhaps unnecessary to go far into the reasons why the latter would doubtless prove to be far more difficult of accomplishment than has been the former. I am not now engaged in presenting a plan of operation or proposing that the attempt at eradication be made immediately. Our knowledge of all the facts involved in the epidemiology of poliomyelitis and especially of influenza may still be too imperfect for immediately effective action. But the very magnitude of the problem of these otherwise uncontrollable epidemic diseases invites to an imaginative outlook which, while perhaps nonrealizable to-day, may not, in view of the rapidly advancing knowledge of the infectious diseases, be hopelessly out of reach to-morrow.

Nor am I insensible to the labor and cost in money and talent which the setting out on such an ambitious enterprise would entail. But here at least is a world problem of such proportions and nature as to invite the participation of all the scientifically advanced countries in a common effort to suppress one of the most menacing enemies of civilized man and of human progress.

In proposing to strive for the high achievement, not merely of parrying the blows struck by destructive epidemics, but of rendering them impotent to strike in the future, we may pause for a moment to reflect on the different ways in which peoples react to great calamities, such as those brought by war and by disease. As the results of a cruel and devastating war, revolutions in governments supposed the most stable may occur; no such result follows upon still more devastating epidemics. The recent epidemic of influenza claimed, possibly, more victims than did the great war, and the losses to the world in emotion spent, treasure consumed and progress impeded are incalculable; yet, through a fortuitous circumstance of psychology, from the one calamity the world may emerge chastened, perhaps even bettered, while from the other, because of a depth of ignorance amount-

ing often even to fatalism, mankind may largely miss the deep meaning of the lesson.

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THE NEW INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY[1]

As a result of conferences held in London and Paris in October and November, 1918, the scientific academies of the allied nations decided to recommend the dissolution of all international scientific associations in existence before the war and the reconstitution of such associations by and among the nations associated in the war against the Central Empires. As a result of this recommendation the International Association of Chemical Societies was dissolved and at a conference held in Paris in May of this year definite steps were taken toward the formation of an inter-allied chemical union.

At this conference delegates from the principal allied nations were present. A provisional organization was effected and a committee appointed to draft articles of confederation. M. Moureu, president of the Federated Chemical Societies of France was elected president and M. Gerard, temporary secretary. After drawing up a statement of the purposes of the new organization the Paris conference adjourned and issued a call for a final conference to be held in London, July 14, for the purpose of perfecting the permanent organization and of passing upon the statutes to be prepared by the special committee. In accordance with this action each of the allied countries was invited to send delegates to the London meeting.

This meeting convened in Salters Hall, London, on July 14 last, and continued its sessions until July 18. The countries represented and their delegates were as follows: Belgium—MM. Lucion and Timmermanns; France—MM. Moureu, Kestner, Behal, Marquis, Marie and Gerard; Italy—MM. O. Severini and G. Pirelli; United Kingdom—Sir William Pope, Henry Louis, H. E. Armstrong, E. F. Armstrong, A. C. Chaston-Chapman and W. P. Wynne; United States—F. G. Cottrell, C. L. Parsons, E. W. Washburn and H. S. Washington.

Practically all of the time of the conference was devoted to framing the statutes of the new international organization and the election of the officers for the first three-year term. The following officers were elected:

President—M. Ch. Moureu.

General Secretary—M. Jean Gerard (49 Rue des Mathurins, Paris).

Vice-Presidents—Georges Chavannes (for Belgium), L. Parodi Delfino (for Italy), C. L. Parsons (for the United States), Sir William Pope (for the United Kingdom).

Communications were received from Canada and Poland signifying their adhesion to the new organization and requesting admission. It was also decided to admit the neutral countries immediately, but the admission of the Central Powers was made contingent upon their admission to the League of Nations. The new union is thus to be international in character instead of merely inter-allied.

The conference also voted its approval of the organization of an International Research Council as contemplated by the Conference of Scientific Academies, and expressed its desire to be included in that organization with autonomous powers as the Chemical Section thereof. It was decided to hold the next meeting of the international chemical union in Italy early in June in 1920.

Previous to adjournment the Conference officially appointed those members of its own body who expected to attend the Brussels meeting of the International Research Council as its representatives at that meeting, for the purpose of effecting the union of the new international chemical organization with the International Research Council as its chemical branch.

The delegates thus appointed re-assembled in Brussels on July 22. This meeting was largely devoted to the discussion, modification and final adoption of the statutes of the

[1] Address delivered at the Fifth National Exposition of Chemical Industries at Chicago, September 25, 1919.