SOME ASPECTS OF EVOLUTION IN RELATION TO DISEASE.

by

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Half a century has elapsed since Darwin gave to the world the evidence he had elaborated in proof of his "full conviction that species are not immutable." It was a very startling pronouncement. Darwin's doctrine seemed to most people to involve the surrender of much of the dignity of man in the acknowledgment of his essential unity with the rest of nature. Materialists wildly claimed that at last their faith had received scientific demonstration. Churchmen thought the very citadels of Christianity were threatened. No wonder then that the controversy has been fierce and the result produced perhaps the most remarkable in the history of human thought. After fifty years during which the world has been re-explored for fossil remains, instances of adaptation and the like, science seems quietly to have accepted the new idea. Biologists, while practically agreed that the theory of evolution gives the most probable explanation of the world of organised life as we find it, are still bitterly divided as to how the changes have come about. Anatomy, physiology, and pathology
have found in the theory the explanation of much that was previously obscure. A new biological theology has sprung up and is immensely popular. No department of thought has entirely escaped the influence of the idea, and last of all, chemistry seems at the birth of almost similar conceptions regarding the inorganic world. It has seemed to the present writer, that the bearing of disease as it affects the race upon the problem of evolution has not been fully realised. It is therefore with the object of bringing together some of the different points of view adopted by various writers on this subject rather than in the hope of making any fresh contribution to it that this thesis has been undertaken.

It is impossible in any paper dealing with evolution to pass altogether without notice some recent antagonistic criticism to which the theory has been subjected. A German writer Fleischmann in his book "Die Descendenztheorie" has made a vigorous onslaught on the theory disputing the generally accepted evidence from paleontology, comparative anatomy, and embryology. I shall not
attempt to state or to discuss Fleischmann's views. Those to whom the original volume is not accessible will find a succinct and reliable account in Morgan's "Evolution and Adaptation". Fleischmann is perhaps most successful in his criticism of the evidence from embryology, but on the whole he cannot be regarded as having seriously weakened the theory. The facts of geological succession seem to me proved and placed for ever beyond even reasonable doubt. A far more serious attack has taken place on the theory as accounting for variation by natural selection. But the most recent writer on the subject (Morgan) finds it impossible altogether to abandon natural selection. He, indeed, criticises severely the conception that natural selection can create new species, but he admits that "the condition of the organic world as we find it, cannot be accounted for entirely without applying the principle of selection in one form or another." I confess I cannot understand how it is possible to hold the principle of natural selection in any form without admitting its all pervading influence. The same law which determines the existence of species must apply to all varieties and individuals whatsoever. Natural Selection seems to me merely an attempt to express in terms of the vital capacity of an organism the resultant
of all known and unknown cosmic forces. Variation must depend mainly on fluctuation about the mean vital capacity for any given species, the deficient tending to death, the exceptionally endowed to further development. Natural Selection does not explain why varieties arise any more than gravitation explains why the apple falls from the tree. It merely expresses what takes place. Too much need not be made either of usefulness in any theory of adaptation. Nature has room in her economy for much that is not merely useful. Nor in our ignorance of nature's aim need we claim too absolute a knowledge of utility. But the very conception of evolution presupposes the preservation of what in the highest sense must be the ultimately useful. I much prefer Bateson's point of view expressed in his "Materials for the Study of Variation" where he says: "In examining cases of variation I have not thought it necessary to speculate on the usefulness or harmfulness of the variations described. Such speculation whether applied to normal structures or to variation is barren and profitless . . . While the only test of utility is the success of the organism, even this does not indicate the utility of one part of the economy, but rather the net fitness of the whole." In other
words nature demands not so much utility of individual adaptations as complete and absolute perfection of structure.

Accepting then the theory of evolution as the most probable explanation of the known facts regarding the history of organised life upon the earth, we may now consider how the theory has entered into our conception of disease: and what part disease has actually played in the evolutionary process.

Pathology has made many contributions to the theory of evolution. Bland Sutton in his work on "Evolution & Disease", has collected a large number of facts showing that structures perfectly physiological at one time in the history of life may occur in pathological relations later. The theory has been applied by Adami and others to the actual history of micro-organisms. Cohnheim's theory of tumours, the explanation of catarrh, some blood conditions, and many other facts of disease given by certain writers are all founded on evolution. Indeed the theory has so powerfully taken possession of some minds that it is said, whenever an organism becomes diseased it reverts to a lower point in the life history of its kind.

There are two aspects of the theory however
which have not been so much discussed viz: the application of the theory to the actual history of individual diseases in the search for some modification of their character, or for new diseases arising in time from old ones: and the evolution produced by disease.

The first line of enquiry is not very hopeful. The accurate disease history of humanity is very short. To found any conclusions on very remote descriptions of diseases still present with us must be somewhat hazardous. Still, disease is so largely merely the result of the attack of the lower forms of life upon the higher, and the theory of evolution being admitted for these, it is reasonable to suppose that some change may have taken place in the manifestations of their presence, - this entirely apart from the modifying factor in the condition of the host. Specificity in disease depending upon species in micro-organisms, the denial of immutability in the latter implies the mutability of the former. There is nothing inconceivable in Collins's idea that all the fevers must have developed from one primordial amoebic fever - in Spencer's phraseology the homogeneous becoming the heterogeneous. Indeed, increasing complexity of
structure must imply increasing complexity in disease manifestations and probably also involves a corresponding development in the external agents producing it. Still, in the known history of disease it is difficult to find great support for the theory, although there is much to suggest it. Collins 116 gives Surgical Scarlet Fever as an instance of a disease arising de novo. The often remarked connection between Typhus and relapsing fever, the varied manifestations of the pneumococcus, the close relation between Tubercle and Leprosy may all be held to be in some sort supporting evidence. But Leprosy appears to have been the same disease from the remotest antiquity. Phthisis Cholera and Plague are all very old diseases and in their present day manifestations they seem essentially the same as in the earliest ages. The history of syphilis also is disappointing. Jonathan Hutchinson 117 remarks:—"If we reflect on the mode in which Syphilitic inoculation is usually effected the wonder will be not that apparent varieties both in primary and secondary symptoms occur, but that the disease is so uniform as it undoubtedly is. Here if anywhere, are the conditions under which we might expect a new species to originate." The history of syphilis will be considered from another point of view later but that syphilis to-day is essentially the
same disease as in the time of Moses cannot be doubted.

From history then we get little support for the theory of the evolution of disease. Not one of the great agents of death can be proved to have changed in any of its essential characteristics. The idea of the evolution of disease is nothing more than a reasonable hypothesis founded chiefly on analogy and probability. Here we have no fossil bacteria to help us — nothing indeed but unaided imagination. Disease species are probably just as certainly not immutable as are all other species, but the hybrids and mules of disease are by no means obvious. Speculation of this sort is interesting, but it is at the same time not a little futile, for the whole subject is obviously beyond the range of reasonable proof.

It is far otherwise with the evolution against disease. One of the grandest of all modern conceptions, it is writ large over all history. Anthropology has built up bit by bit the stone age of the world's history by a study of living peoples upon the earth actually at that stage of human development, and something of the same sort may be done for disease. Although far too little is known of the diseases of these primitive
peoples, it is possible broadly to see how they suffer and in what way they differ from ourselves in their disease susceptibilities. I think the process also by which the race in the course of centuries shakes off diseases ought to become clearer. I feel sure something may thus be learned of nature's method so that we may work with her and not against her - surely the chief end and aim of all our efforts.

We are not now considering the marvellous growth of power to control disease which increasing knowledge, the result of enforced thought on the most harassing problem of existence, has given to man. It is rather our object to determine what part disease itself, apart from all human intervention, has played in human progress. Can it be said that there is a tendency which no human agency can resist for disease in the history of the race to effect its own cure? There are two ways in which the problem may be approached. We may study the history of individual diseases in certain communities and attempt to establish a progressive amelioration in their relation to them; or we may contrast savage and civilised man in their behaviour to the same diseases. Should we be able to prove that the longer a community is in contact with a disease the milder that disease becomes;
or if we can show that savage man differs greatly from his civilised brother in his susceptibility to disease and in the acuteness of his disease processes, we shall be compelled to admit an evolution in relation to disease. It will then be necessary to examine as many as possible of the factors bearing on the problem in order that we may ascertain how far that evolution has been produced by disease and how far by the application of our ever increasing human knowledge.

Let us now turn to the evidence from the history of individual diseases. Most modern writers are agreed that Syphilis has become a much milder disease during the last two centuries than when it first invaded Europe. Mr Lee has treated this subject in his "Lectures on Syphilis" (Lect. XI. p. 209). It will not be out of place here however to go a little fully into the matter.

No one who looks into the Literature on the history of Syphilis in the 15th Century can fail to be struck with the constant reference to the pustular eruption which then apparently always accompanied the disease. The pustules are described as of all sorts and sizes appearing first on the face and spreading to the rest of the body and to the limbs. In the appendix will be found some extracts from early writers bearing on this and other points. I cannot forbear from quoting here two extracts, one from the French of J.M. Guardia
writing in 1863, who gives a more or less free translation of a paper by Villabobos on this subject dated 1498. The other from a paper by Dr Chas. Renaultl11 on "Syphilis in the 15th Century." The first will show the general characters of the disease; the second its dreadful epidemic prevalence.

M. Guardia's translation:- "Here are the signs that announce the approach of the evil. A little wound on the member, ugly, with hardened edges, 'indolente', pains in the head, livid complexion, weight in the shoulders, insomnia, dreaminess, strained eyes, dry lips, covered with fur; inertia of the limbs, general fatigue, indolence, troubled sight, after that come the pustules, terrible pains in the joints from the shoulders and then to the knees and to the crest of the Tibia; the dried up tumours emptied of the excessive heat of their subtle parts form swellings chiefly on the forehead and head: the glands swell and the soles of the feet and the palms of the hands become blood red, and itch and are more painful towards the beginning of the day. The forehead is flushed and burning: the shoulders very painful, and as it were crushed beneath a great weight. No rest. The postules burn like fire. When their number is considerable and they
ulcerate, the pain is at its worst in the middle of the day. Sometimes the pustules are farther apart, larger and less painful."

Dr Renault writes:— "As soon as it was realised that the disease was contagious, terrible by its numerous successive accidents, considered incurable by most doctors, the greatest terror got hold of the people. The unfortunate folk who were smitten with syphilis were exposed to every misery and even the Lepers fled from them. Grumpeck being unable to conceal from his friends that he had been attacked was immediately abandoned by those who had just made the warmest declaration of friendship. In Germany the panic was so great that lepers refused to sleep in the same houses: no one would speak to the diseased: doctors refused to tend or visit them: they were abandoned as dead, and lived as they could in field or forest."

Now we are instructed at the present day in the differential diagnoses between Syphilis and smallpox, and every doctor occasionally sees a case of Syphilitic ichthyma corresponding to these mediaeval descriptions. Moreover, outbreaks of syphilis have occurred in more recent times accompanied by this symptom. J.L. Milton in his "History of Syphilis" quotes Mr Lee's description of an outbreak which occurred at Rivalta.
about 1860. Mr Milton contends that this is merely a proof that syphilis has not changed, and he adds, "It may be said that the complaint resumed its old severity at Rivalta because it broke out in a new country; in that case every little outbreak of Syphilis in hitherto uncontaminated places, ought to take on the features which the terrible epidemic wore to the eyes of Grumpeck and Frascasin." But it may be that this to a certain extent is really the case. The characters of the skin eruptions in syphilis are extremely various and this variety must be the direct result of the character of the poison and the susceptibility of the individual. We should expect to find in a community previously untainted with syphilis an acuter response to the poison and amongst other things the severer forms of rashes. I do not know whether the pustular eruption usually accompanies syphilis when it first attacks primitive peoples, but it is matter of common knowledge that under such circumstances, the disease does work great havoc. There is however this fact to be stated as possible confirmation of this view. If the modern contention that the tropical disease Yaws is really Syphilis is true, it would be just the evidence we need,
for modern descriptions of that disease correspond most strikingly with those of mediaeval syphilis. Here, for instance, is an account of Yaws as seen amongst the natives of Rotuma by Mr J. Stanley Gardiner. "It begins," he says, "with fever and constitutional illness, by a pustular eruption on the hands, feet and body. The pustules increase with tumours, ulcerate, break down, discharge and dry up."

With regard to the question whether Syphilis was ever an epidemic disease, the extract above quoted and several others in the appendix will show clearly the view held at the end of the 15th Century. There can be no doubt that at that time there did take place an epidemic-like diffusion of the disease. Whether this was due to an unusual intensity of the virus, to diffusion by Charles IX's and other armies, and to the depravity of society generally, or to a true contagion is difficult to decide. Sir J.Y. Simpson held strongly that it was an error to believe that syphilis has ever been simply contagious or epidemic and explained its rapid spread as due to the gross immorality of the clergy, soldiers and others. But epidemics in comparatively recent times are well authenticated. Dr Clemow in his recent book on "The Geography of Disease," records a
number of these. It will be sufficient to mention the form of Syphilis called "Sibbens" or "Sivens" which appeared in S.W. Scotland and later spread to the Highlands in the middle of the 17th Century, probably a direct result of the invasion of Cromwell's troops. One may also cite the Holstein disease - a severe epidemic of syphilis which was introduced into the Suder - Dithmarschen by the foreign navvies who came to embank the Crown Prince's Dyke in the 18th Century, and continued for long to ravage that country. I can conceive no difficulty in believing that in a community absolutely ignorant of the infectious nature of the disease and in which the mode of life made both venereal and non-venereal forms of infection easy, that Syphilis would inevitably take on epidemic characters. Indeed this happens constantly amongst the Russian peasantry and in China.

It seems therefore highly probable that a progressive amelioration has taken place in the type of Syphilis. The reasons for this will be discussed in the sequel. I think I shall be able to show that in spite of what may be attributed to the effect of treatment and to the improvement in public morality one cannot ignore the influence of natural selection acting through heredity in communities long afflicted with the disease.
A similar amelioration, it is well known, has taken place in certain parts of the world in the type of such diseases as Malaria, Typhoid, Cholera and Phthisis. The universal law seems to be that the longer a community has been in contact with an infectious disease the greater its immunity from it. As a general rule savage peoples exhibit a high degree of susceptibility to all infectious disorders. The study of primitive peoples in relation to disease is surrounded with difficulties. Travellers, missionaries, and others while reporting many interesting facts with regard to native habits, mode of life, government etc., have as a rule treated of their diseases only incidentally.

There is also this further difficulty that although primitive communities are necessarily isolated from the rest of the world, the advent of the traveller and missionary implies an end to this aloofness from the contamination of more advanced peoples. Very few accounts exist of the diseases actually prevalent on the discovery of any aboriginal people, as distinct from those afterwards introduced. The facts moreover are often stated on authority which is not medical. Subject to these remarks it may be worth while to make a few extracts from existing records and then attempt to generalise their results.
P.K. Granville writing on the Jekris, Jobos, and Jijos tribes inhabiting the Warri district of the Niger Coast Protectorate in 1890 says:

"Malarial fever, dysentery, diarrhoea are common: so are crawcraw, eczema, and all the chest complaints. Valvular disease of the heart pointing historically to rheumatic fever is not uncommon: slight cases of leprosy exist and ulcers of the legs are very common. There is a curious but severe diseased state during which the skin and flesh waste away but it is curable. A troublesome complaint because there appears to be no cure for it is this. The skin splits round the base of the great toe, hardens gradually to such an extent that the circulation is stopped and the toe withers away. The form of smallpox which affects the natives more or less severely is not found to communicate itself to Europeans. Epilepsy and hysteria are met with. There is very little ophthalmia. Toothache is only caused by deterioration due to the enamel being knocked off by a blow. The jaw being large and the teeth wide apart nothing gets fixed between. Albanism is found in all the tribes, but no polydactylysm, steatopygea, cleft palate nor hare-lip were observed. Idiots exist, but no special attention is paid to them. There is occasional baldness in old people. Club foot has been seen."
This is the fullest account of the diseases of a primitive people at first hand which I have been able to discover and I have thought it worth while to quote it in extenso preparatory to discussing the whole question.

Whether or not man appeared upon the earth in one or several places, the first human colonies must have been intensely isolated from each other. This aloofness from their kind is the leading characteristic of primitive peoples to this day. Natural barriers - great mountain ranges, broad swift flowing rivers, trackless marshes, vast impenetrable forests where lurked ten thousand demon agencies (the creatures of an imagination living for ever in great fear of the unknown), fierce tribal wars, and man's limbs his only means of locomotion, - these and the countless problems of his own mind and body and environment which man has had to solve, have kept aboriginal peoples distinct and different from the rest of mankind, - the living fossils of human history. From the point of view of disease this isolation limits the possibilities. The civilised child in its nursery is protected from disease by isolation, by tender thought, in the application of knowledge accumulated through the ages. Nature also has her nur-
series where she guards her children in her own way, with all the wisdom of infinite knowledge and with boundless success. For civilised man was once savage and nature has been his only teacher. Embryology has been held to afford convincing proof of the theory of evolution by giving in the development of the human embryo an actual record of the process. Whatever may be thought of this view, - and it has recently been much attacked, - in civilised childhood we no doubt ought to find some suggestion of the history of the race in its relation to disease. Ignorant and helpless, careless of injuries, by constitution and mode of life a prey to all infectious diseases, primitive man, by the teaching of the inevitable destiny of death, has become 'civilised', living in the most remarkable immunity from diseases once terribly fatal. Yet our children still show a high degree of susceptibility to infectious diseases, and every now and then in a form sufficiently acute and deadly to remind us of what has been.

There are some other considerations worth mentioning before we proceed to the more particular study of savage communities in their relation to disease. The extraordinary recuperative power of the savage has often been the subject of remark. Dreadful injuries from which he recovers with sur-
praising ease have been recounted, and feats of great endurance on the part of their women immediately after child-birth. This power civilised peoples are said to have lost. Perhaps too much has been made of this. There would be no difficulty in finding instances amongst civilised peoples of recovery from accidents as serious as could possibly happen to man. The most delicately nurtured people recover as well as the savage from grave surgical operations. After all the great test of the recuperative power of an organism is in recovery from disease, and in that respect primitive peoples have certainly no special endowment. The exact opposite is the truth. They succumb with the greatest readiness to all infectious diseases except those with which they are immediately in contact.

Many writers on aboriginal peoples in different parts of the world remark that these were healthy before the arrival of Europeans. There is indeed a popular superstition that disease is a product of civilisation. People who hold this view believe that had man remained the wild naked hunter of the stone age he would have known nothing of the dread death-dealing scourges which now infest cities and countries and continents
and at times the whole world. But disease is so much merely the reaction produced by the attack of the lower forms of life upon the higher I cannot think there ever was a time when organised life was invariably normal from birth to dissolution. Is it possible to imagine the most primitive simplicity of structure as free from abnormalities of development, inherited vices of constitution, or acquired disharmonies in the rhythm of its life? The monstrous is as much characteristic of nature as the perfect. From the grasses of the field to the human cradle aberrant forms appear. We cannot read the record of life's age-long struggle with disease but surely, chiefly by the power of death, organised life has been impelled ever onwards towards that unknown destiny which awaits mortality.

The actual facts with regard to primitive peoples support this belief. Hare lip and other physical deformities are found, and idiocy is mentioned. These are probably not so frequent as in civilised communities because in a hand to hand struggle with nature, abnormal forms have less chance of surviving. Many savage tribes also practise infanticide and doubtless malformed babies would be most readily sacrificed. Some peoples like the Maori have traditions of dreadful
epidemics before the European came. In nearly all there is found a great dread of disease. Take the following from the notes on the natives of Savage Island by Basil Thomson 115 - "Dr Turner who visited the island in 1849-59 writes - 'Natives of other islands who drifted there in distress, whether from Tonga, Samoa, or elsewhere, were invariably killed. Any of their own people who went away in a ship and came back were killed, and all this was occasioned by a dread of disease. For years before they began to venture out to ships, they would not immediately use anything obtained but hung it in the bush in quarantine for weeks.'... The Rev. John Williams during his memorable voyage in the "Messenger of Peace" in 1830 recruited two Micé Boys and subsequently sent them back to the island as teachers: but after a time Influenza having broken out among the natives, and the boys being accused of bringing it from Tahiti, one was killed together with his father; the other escaped."

Another instance may be quoted from H.O. Forbes 115 writing "On the Ethnology of Timor-laut" a group of islands in the Malay Archipelago. "The natives"he says"sear themselves on the arms and shoulders with red hot stones, in imitation of immense smallpox marks in order to ward off that
It is safe inference I think that what these peoples dread they must have experienced. Is it not possible that in this dread of disease might be found the explanation of the dreadful mutilations practised by savage peoples. Some spiritual interpretation is usually given for them; but to account for the practice of circumcision by some sacrificial instinct necessitating an offering to the dread power who presides over the fruit of the womb, seems to me in the last degree fictitious and imaginative. Circumcision is practised by peoples who have not the most rudimentary religious notions - the Bechuanas for instance. Philo, the Jew, was much nearer the truth when he ascribed it amongst other causes to the fear of 'carbuncle'.

Further characteristics of barbarous peoples generally noticed are an enormous infant mortality apart from infanticide, and a scarcity of old people. Their behaviour also when attacked by disease is characteristic. The individual submits with all the Mohammedan's belief in 'Kismet'. The Maori for instance will count up the days he has to live, and die to the day. The community becomes panic stricken, villages are abandoned, and wild flight takes place to the woods.
The important point however to establish for our purpose is the extraordinary susceptibility of savage folk to infectious diseases. As C.M. Bell remarks in his interesting book on "The Mosquito Indians" of Tangwera - "The life of a savage people is peculiarly tender. Though strong, robust, and sound in constitution, they are especially liable to be infected by the germs of disease, generated by large communities. Thus smallpox, measles, whooping cough, cholera, and even common catarrh are very destructive to them. This is matter of common knowledge, but the fact is so vital to our argument, I have thought it worth while to submit a number of instances collected from various sources.

The fearful ravages produced by measles, and smallpox introduced into newly discovered America are well known. R.B. White in his "Notes on the Aboriginal Races of the N.W. Provinces of South America," remarks:-

"The importation of smallpox and the spread of certain diseases after the conquest were fatal circumstances for the Indian population. They were carried off by these diseases in thousands."

A Simson writing on the Pjojes of the Putumayo - the chief tribe of Indians inhabiting the border of the Upper Putumayo - after remarking
on the frightful havoc made among them by smallpox says, "that this disease should depopulate districts of human beings living under the conditions that Indians do does not appear extraordinary; but that this should be equally the case with catarrh is likely to convey some astonishment to the mind of the European . . . . "Like the Pjojes of the Napo whose salutation is 'huarrahue' while indicating the nose - but in a milder degree - the Pjojes are much alarmed when anyone appears amongst them with evidences of cold in the head, for they seem to take the contagion with great facility and it soon assumes a most fatal form of influenza with high fever which soon results fatally. On my descent of the river the Consacenti Indians accused me of bringing catarrh to them with my party when passing their place on the upward journey. I denied having done so as none of us were suffering from cold. Two months afterwards I heard from a friend who had visited the same village that nearly all its inhabitants had died from the effect of the cold they had, and which they sometimes appear to contract by mere contact to the white man."

W.H. Head 115 who was for more than thirty years on Savage Island states that "Yaws and Phthisis were quite unknown before the arrival of the Samoan people. The natives when he first arrived generally
seemed to die of old age, coughs and colds were then unknown, the diseases of that time were, - Makulokuli, (a difficulty in passing water), Lupus and scrofula. Since the intercourse with ships, the policy which earned for the Micó people from Cook the name of the Savage Islanders has been amply justified. In these days every child has Yaws as a matter of course, though the disease might easily be stamped out by isolation. Whooping cough has never left the island since its introduction; measles introduced in 1898 by a returning labourer occasioned about 100 deaths. Syphilis, unknown thirty-four years ago, is said to be very prevalent in the tertiary form."

H.A. Wickham 115 in his "Notes on the Soumoo or Woolwa Indians of Blewfield River, Mosquito Territory," says:-

"Like most primitive peoples, they seem to be very sensitive to imported diseases. At the time I was amongst them they suffered from cholera. It had been introduced to Blewfields by some half breed Mosquito men who had put into that place after having pillaged an American steamer which had been abandoned at the San Juan river on account of the disease.

It spread among the Indians with great rapidity killing a large number. Those in infected villages abandoned them and fled to the woods."
Measles gives many striking illustrations of this peculiar susceptibility in aboriginal races. This disease was brought to Fiji from Samoa in the retinue of King Kokobau and caused a very intense epidemic, as many as twenty thousand of the natives, or between one fifth to one quarter of the population dying from it. The natives of the River Amazon and in Astoria, the Indians of the Hudson Bay territory, and the Hottentots at the Cape, and the natives in Tasmania, and in Mauritius have all suffered from similar deadly outbreaks. These instances might be multiplied indefinitely. It is unnecessary however to add to them.

From another point of view the testimony is remarkably conclusive. Aboriginal peoples in all parts of the world are gradually disappearing, and the chief cause of their destruction seems to be the inevitable contact with new diseases which civilisation implies. There are other factors such as changes in mode of life, and the adoption of imperfectly understood habits, but these really act by inducing disease. Take the testimony of Captain Condor R.A. 115 on the present condition ('87) of the native tribes in Bechuanaland.

"Their physique" he says "is deteriorating" due to the influence of the whites, breaking up the
old social system, the laws and customs of which were well adapted to native life, and to the introduction of brandy and syphilis. It is thought that the adoption of European clothing has affected their health but there are clear indications that asthma, consumption, and lung diseases from which the natives suffer are congenital and to be ascribed to the excesses of the parents on whom the white man has had a disastrous influence. Syphilis is frightfully prevalent among the Mari Batlaping, also the Batlaping of Taney; among the Baralong it is less general; generally attributed to white people. The congenital diseases among the children appear to be such as would result from parental syphilis."

Kerry Nicholls writing on "The Origin, Physical Characteristics and Customs of the Maori Race" says: - "The three principal diseases conducive to the decay of the race I found to be phthisis, chronic asthma and scrofula, - the two first being principally brought about I believe by a half savage half civilised mode of life, and the latter from maladies contracted since the first contact with the European."

A.L. Bennett in his "Ethnographical notes on the Fang" - a race inhabiting a portion of the French Congo, says:- "A very noticeable fact among
the Fang is the scarcity of old men. I attribute this largely to the ravages of syphilis, the same terrible disease that has done so much towards the degeneration of numerous coast tribes, and which is already playing fearful havoc among them." (1899)

C.N. Bell in his interesting book "Tangwerra" says:- "The Mosquito Indians were once very numerous, but they are greatly fallen off in number. The reason of this decline is very difficult to account for. Generally savages die off in the presence of civilised races because of the change of life, and habits induced or imposed on them by the superior race; but it is evidently not so in their case. The Mosquito Indians have not changed their habits. This decline in numbers affects all the Indian tribes of the country ... Even periodical visits of epidemic diseases cannot account for a steady decline in numbers extending over more than half a century. If the people were fecund they would soon make good their losses. The root of the trouble is a great infant mortality and small birth rate. All the American Indians from Canada to Cape Horn have suffered from this blight with the exception of the Mexican Peruvian, and Central American Indians of the Pacific Shores. These had attained
an indigenous form of civilization and though not proof against our diseases their fertility secured them from extinction. The causes of the dying out of savages in the presence of a civilized people have been totally misunderstood and wrongly diagnosed by Europeans. When the American Indians, the South Sea Islanders, the Fijians and the Maori race were constantly at war and devouring each other as cannibals, they were happy prosperous, and most numerous; but as soon as they abandoned tribal wars, and attempted to live the life prescribed by civilization, they were stricken by the hand of Death. They are told by a race they respect for its superior arts and knowledge, that if they leave off fighting, have only one wife, till the soil, and live an industrious life, all will be well. They tried it and invariably found that the whites are blind guides of the blind, and that if they changed their old way of living there is only one option left to them and that is the grave." This writer seems to sigh for the good old cannibal days! I suppose the first missionaries to Britain must have made things more uncomfortable for our aboriginal ancestors than the white man has done for these poor Indians. No doubt they had to go very much as the Indians and all the others are going.
Nature evidently does not intend that anywhere in the world the stone age shall exist for ever.

A. C. Haddon\textsuperscript{115} writing on "The Ethnography of the Western Tribes of the Torres Straits" says:-- "Smallpox, measles, and syphilis had been introduced; the two former have caused the death of large numbers of people."

Dr McNabb\textsuperscript{115} Surgeon R.N., writing on "Diseases in the New Hebrides" gives it as his opinion that Bronchitis, and other lung troubles which are very common there are due to the encouraging of clothing which is never changed. Venereal diseases are also common, due to intercourse with the whites.

J. Stanley Gardiner\textsuperscript{115} writing on the natives of Rotuma, an island about 280 miles N. by E. of Vita Leon, Fiji, ascribes the cause of their decrease chiefly to epidemics of dysentery, whooping cough, Dengue, Influenza, and Measles.

Seymour H.C. Hawtrey\textsuperscript{115} writing on "The Leguan Indians of the Paraguayan Chaco" says:-- "Indeed the wearing of left off clothing becomes a source of actual danger to them on account of infectious diseases from which amongst themselves they are remarkably free . . . . But to an unbiased observer it is evident that if no means can be taken to prevent the increasing influx
of a debased form of civilization whose chief agent is rum, it will not be many generations before there are no more Chaco Indians to discuss".

Dr Phillippe whose work on Easter Island is based on official reports by Captain Gaona of the Chilian Navy and Pere Eyraud one of the earlier missionaries, says: - "M. Eyraud on his arrival in 1863 found 18 hundred inhabitants. In 1868 there were 930; but in 1870 only 600 remained. This great diminution is said to be chiefly due to the introduction of smallpox by the survivors from the Guana Islands after the deportation of the Peruvians. It is to be feared that the whole race will rapidly die out." Scrofula, tubercle and early marriage are mentioned amongst the causes.

These extracts will be sufficient to show how in the words of H.E. Hunt\textsuperscript{115}, "unintentionally perhaps, but none the less certainly, the white man carries with him wherever he goes causes which ultimately destroy the native populations. Foreign food, foreign clothing, intoxicating liquors and the direct introduction of specific diseases all tend to the one result."

In North America an eloquent writer in the Encyclopaedia Britannica remarks: - "Two hundred years ago the aboriginal population would have deserved description before the immigrant popula-
tion. To-day the aborigines are displaced from all the most valuable parts of the Continent. Never very numerous, they are now decreasing; many tribes are already extinct; many more are almost so. The replacement of the native races by the foreign has too often been harsh, cruel, and unjust, yet it has resulted in the advance of civilization. Many savage tribes speaking many different languages, holding little intercourse with each other, and frequently engaged in inter-tribal wars, have given place in little more than two centuries to a great population of European origin, whose dominant parts speak one language, whose arts are highly advanced, whose home intercourse is most active and whose foreign commerce has attained unexpected proportions at the beginning of the 20th Century."

The Polynesian race also is shown to have continuously and in some cases, rapidly decreased since their first contact with Europeans. A moderate estimate by George and T.R. Foster, puts the falling off from the time of Cook's last voyage, 1774, at about three fourths. The people are tainted with leprosy, and elephantiasis, but wars, massacres, slave raidings, epidemics such as that of smallpox which swept away thirty thousand Fijians in 1878, the introduction of strong drink, and the effect of the sombre type of Chris-
tianity preached by the missionaries are given as true causes.

In Australia it is certain that aborigines are very much less numerous than when the country was first colonised.

It is perfectly clear then that primitive peoples are disappearing from the earth. It seems also certain that the chief cause of their destruction, either directly or indirectly is disease. No stronger proof could be submitted than this, that the race has evolved a remarkable power of resistance against disease. Could any contrast be more striking than that between simple savage communities panic stricken by an epidemic cold and elaborate centres of civilization for the most part almost unconscious of, or at any rate able to live in indifference to the presence of infectious diseases.

The rest of this paper will be devoted to a discussion of some of the elements involved in this great change. It ought thus to become apparent how disease affects the race and some purpose may be discovered in the seeming meaninglessness of the great death-dealing chances of existence.

Of all the forces against which man has had to battle perhaps the most powerful to awake intelli-
gence must have been disease. The savage mother with her dying babe upon her knee sits and broods in an angry agony of despair, seeking in her dull brutish way some chance to cheat the dread spirits of their prey. The young primitive hunter, leader perhaps of his people in many a wild fierce onslaught against the savage denizens of the forest or furious human foes, stricken by the secret unseen agents of disease must have powerfully stimulated to thought even the most careless of his brethren. Thus gradually, from a belief in spirit agency as the chief cause of disease, - a faith in which half the peoples of the earth still linger, - man has come to know his subtle foes and has learned to guard against their attack.

Obviously then in great part this evolution against disease has been simply a developing knowledge of how to prevent it.

We shall now pass rapidly in review some of the elements involved in this change.

Reflect for an instant on the question of food. How great has been the influence exerted upon the temperament, the health, the vigour, and the intelligence of mankind by advancing knowledge of what foods were good to eat, how they could best be obtained, and how kept pure. The problem of subsistence for primitive man must have been
an extremely grave one. No doubt he lived an existence of alternating feast and famine, and in this may be found the explanation of the absence of restraint in matters of eating and drinking which characterises all barbarous peoples. As a hunter and fisher how little could he know of the possibilities of his environment, with regard to food, and how precarious must have been his supplies. When he took to rearing cattle and sheep his chances were better but not until he attempted agriculture and became industrious in tilling the soil, could his supplies of food be anything but scanty.

This evolution is remarkable, but even more striking is the disease knowledge which has accompanied it. When we consider how great the influence of diet from childhood to old age and how subtle and wide reaching are its disease possibilities we cannot but marvel at the success with which nature has taught man to feed himself without fear of injury.

Let us pass rapidly in review a few of the diseases which are directly due to food. The association of berri-berri with decorticated rice so long noticed is now well understood since Captain Rost I.M.S. has described (Indian Medical Gazette December 1900) a spore bearing diplo-bacillus
found in the rice sold in the bazaars in infected districts. The association of diabetes with farina-
aceous foods has been held to explain the prevalence
of that disease in India and Ceylon. Improper
foods as a cause of Diarrhoea is popular knowledge.
Manson has established a connection between
unripe maize and epidemic gangrenous rectitis.
He tells us that this is the reason why it occurs
so commonly amongst children in Venezuela because
the children there have the habit of chewing the
green tender stalks of the unripe cereal being very
fond of it on account of its sweetness. Ergo-
tism and rye bread or other food stuffs made from
rye; gout and luxurious feeding, leprosy and fish
particularly badly sorted and decomposed: are all
diseases directly attributable to these foods.
Pellagra and damaged grain is another common in-
stance of a disease due to food. In Italy where
the people eat polenta or maize porridge it is
very common. Other such disease associations are
rickets, and deficient or improper feeding;
scurvy and prolonged deprivation of fresh vege-
tables, typhoid and contaminated food, cholera,
dysentery, malaria typhoid and contaminated water.
One need only mention alcohol and its thousand and
one disease manifestations.
This formidable list might well be extended. It is sufficient, however, thus rapidly to have reviewed this connection between food and disease to suggest a remarkable development of human knowledge, the application of which, is slowly ridding mankind of all such diseases. Improvement in the quantity, quality and purity of the food supplies is characteristic of advancing civilization. How young the world still is in this matter may be learned from the fact that more than half the peoples on the earth are still in absolute ignorance of the diseases caused by their food, and the other half has only begun to apply its knowledge. Amongst ourselves it is still possible to assert that nearly all the diseases of the poor are due to under or improper feeding.

From another point of view the matter of food bears upon our subject. Habits with regard to eating help to explain some of the known immunities from disease. The extreme rarity or entire absence of taenia solium amongst orthodox mussulman communities is obviously due to their abstinence from the flesh of the pig, and the same may be said of other such purely vegetable feeders as the Hindoos, the Egyptians and others. The immunity of the negro from calculus may also be explained by his food habits.
In the matter of clothing also how great has been the advance in human knowledge under the teaching of experience. We have seen how savage communities in their ignorance lay themselves open, not only to infectious diseases, but also become a prey to chill, bronchitis, and pneumonia. How many diseases are prevented by the mere clothing of the body, - diseases like Mycetoma which the European and Eurasian entirely escape merely by the custom of wearing boots.

How much also has been learned in the way of warding off disease in association with human dwellings. The natives of Italy for instance, and the peasants of many other malarious countries secure a relative or certain immunity from that disease, by building their dwellings on supports at a considerable height from the ground.

The absence of flooring to huts enabling rats to gain free access to them may account for the easy spread of Plague in some communities. The slowly recognised association of diseases like cancer, tuberculosis, epidemic cerebro-spinal meningitis, diphtheria and rheumatism, with certain houses has led to an organised attack which will no doubt be further developed on those diseases in their breeding places. Facts like the cereal spread of smallpox from hospitals to near towns and many others which will occur to
everyone have had to be slowly and painfully accumulated under the inexorable teaching of experience.

There are many other general factors making for freedom from disease as civilisation advances. The knowledge of how diseases associated with certain occupations may be guarded against: a growing tendency to avoid war or at any rate to prevent its enormous death roll from cholera, dysentery, typhoid and yellow fever; restrictions with regard to all great movements of human beings for any purpose whatsoever all tend to this result. The tenderer care of children, the recognition of the evil influence of over-work, under-feeding, insanitation, and over-crowding, are also important factors. So also is the improvement in public morality. It is difficult to understand the position of those who contend that there has been no improvement in this respect. Savage people are for the most part non-moral rather than immoral. The Zulus are often instanced as a remarkably moral race. But there can be no morality apart from choice and free from penalties. If the penalty attaching to immorality is death, as it is amongst the Zulus, morality becomes a matter of expediency,
or in other words, is changed into a legal code. Civilization is often regarded as synonymous with license. It is synonymous with liberty, and immorality, as in all else, liberty makes progress possible. If we reflect on what must have been the moral condition of England in the time of Cardinal Wolseley when we learn that that high church dignitary was able to have inscribed over one of his houses the words - "Domus Meretricum Sanctissima Cardinallis" without exciting any public comment whatever it is impossible not to marvel at the ignorance which excites the present day wail about the degeneracy of our times.

It is necessary here to mention however certain diseases which seem rather to be the accompaniments of advancing civilization. Cancer is a disease from which primitive peoples seem to suffer little. The Negro is said to possess a remarkable immunity from it. Diphtheria mostly occurs in communities which have reached the stage of public education. Diabetes seems largely predisposed to by the luxury, the sedentary life, the mental strain, worry, anxiety, and 'nerve wear' of civilised existence. All that is meant by the neurotic temperament, and most nervous disorders, not directly congenital are probably the direct outcome of civilisation. These it may be are the diseases of man's intellectual infancy as most infectious diseases are of his physical
childhood.

We have now discussed some of the factors explaining the comparative immunity of civilised communities from infectious diseases. By far the most important factors still remain to be considered. It will be admitted I think that of all these the most vital is a general improvement in the environment of human life. The number of diseases directly or indirectly dependent upon mediaeval conditions of life is legion. Let us consider for a moment some common diseases from this point of view.

Cerebro spinal meningitis is a disease which seems to be determined in its epidemic manifestations by the character of the surroundings of those attacked. It is always found in the poorest quarters of towns where dirt, over-crowding and insanitation are found at their worst. This may explain the peculiar susceptibility of the negro to the disease.

Dengue is another disease where these conditions are of great importance. Many forms of diarrhoea are directly attributable to the neglect of sanitary precautions. The same may be said of dysentery. Of ergotism it is known that unhygienic conditions seem to favour the development of the malady, as in insanitary prisons, foundling hospitals, and similar institutions. Erysipelas,
although epidemics of the disease have been known
to occur in hospitals above reproach in regard to
cleanliness, structure, ventilation, over-crowding
and general hygiene has generally been found in
association with sanitary defects, - in some
instances for example with the escape of foul
air from sewers or refuse heaps into the wards.
The association of malaria with insanitary pools
in the neighbourhood is well known. The Registrar
General (1891 Report) points out that the high
maximum mortality rates from measles occur in
neighbourhoods where bad insanitary conditions
exist. Mediterranean fever, Hughes believes, is
largely associated with insanitary conditions and
particularly with a sewerage soaked soil. Ophthalmia
and trachoma are usually found in poor overcrowded
communities where the use of towels and handker-
chiefs in common, and dirt and mal-hygiene genera-
ally greatly favour their spread. Pollution of
the soil, imperfect removal of refuse and filth
accumulations have been frequent accompaniments of
severe plague epidemics. It is probable that in-
sanitary conditions aid to a considerable extent
in the production of epidemic pneumonia. Dirt and es-
cape of sewer gas into houses may not be without
influence. These factors have usually been at
work in the well known epidemic prevalences of pneumonia in such institutions as gaols, barracks, or schools. In such epidemics too, over larger areas, the most insanitary dwellings in the area seem to have suffered most. The importance of ill nutrition and over crowding in relapsing fever has long been recognised. The association of rickets with improper diet, bad air, over crowding and general bad hygiene has long been held to explain the prevalence of that disease amongst the children of the poor. Over-crowding, insanitation and all that they imply probably favour such diseases as scurvy. It is unnecessary to point out how a low level of personal hygiene and public health administration must favour the prevalence of such diseases as smallpox and scarletina. It has already been pointed out how under such conditions syphilis must be a common disease. Trismus Neonatorum is a common disease in all parts of the world where the children are not kept scrupulously clean, and are allowed to roll about on the dirty floors of crowded and insanitary huts. Over-crowding and deficient ventilation are powerful aids to the diffusion of tubercular diseases. Hygienic defects of all sorts are usually found in association with a high degree of typhoid prevalence. Typhus is notoriously associated with ill nutrition, over-crowding, misery and insanitation.
Dirt, filth, and insanitation generally are needed for the genesis of yellow fever, or at any rate for its development into an epidemic. As Hirsch 107 pointed out, epidemics have always started "in seaports, in the immediate neighbourhood of the harbour and the wharves and generally speaking in the filthy quarters of the town, the centres of poverty, misery, and vice, with their tenements densely crowded from cellar to garret, their taverns, dancing saloons, and lodging houses. It is after the epidemic has come to a head in these purlieus that it begins to spread always in the first instance into the immediate neighbourhood; but not infrequently it remains confined to them, and other parts of the town some distance off and better situated hygienically may be little troubled by the sickness or not at all." Readiness to take precautions is then more or less characteristic of civilized communities and obviously explains to a great extent the immunity they enjoy from infectious diseases. How important have such measures been again and again in preventing the spread of diseases like cholera. These instances have however all occurred in countries far removed from the original source of the disease in the East. It has not yet been proved that they can be equally successful in countries near to India.
With regard to malaria also, both for the individual and for the State this alacrity to accept the teaching of science is the determining factor in the limitations of the disease. By the draining of marshes and swamps, by the cultivation of uncultivated land, by the construction of dykes and dams to prevent the flooding of low lying areas by rivers or by the sea, Holland has practically rid itself of the disease. In India and W. Africa the attack upon the malaria bearing mosquito and like protective measures have been crowned with encouraging success. We have recently at our own doors had evidence of this in the outbreak of Plague at Glasgow. Without the knowledge or willingness to recognise the first cases of the disease or premonitory rat sickness and to take early measures in consequence, what might not have been the result. Smallpox too, in relation to vaccination and re-vaccination is another instance in point. Instances like the action of the Public Health Authorities in the matter of the typhoid infected blankets imported from S. Africa occur with great frequency. It is not possible to over-estimate our debt to our elaborate Public Health organisation ever ready instantly to deal with imported diseases in every shape and form. No doubt in the further application of scientific
knowledge to civic life we shall find still further immunity from diseases. But when we consider how prevalent even in the most advanced communities diseases like scarlet fever, diphtheria, measles and typhoid still are; how many diseases there are which no conceivable system of civic hygiene could ever either prevent or control; how in fact, all public actions with regard to disease must be merely prophylactactic - for the absolute annihilation of all the organismal causes of disease is beyond the range of reasonable possibility - it is worth while to enquire whether nature herself may not be slowly ridding mankind of all his infectious diseases.

We have now considered some of the causes which have led to an increasing immunity from infectious disease as civilization advances. It may be well however now to glance rapidly at some of the natural limitations of disease. These are causes limiting disease mainly by affecting the saprophytic existence of micro-organisms. Temperature is one of some importance; cold, for instance, was once supposed to be essential to the production of cerebro-spinal meningitis. But as Dr Clemow65 points out "a disease which can cause severe epidemics in Indian gaols among the poor of Jamaica and on the tropical coasts of W. Africa cannot in any way be dependent for its causation on absolute cold". Still, a
relative degree of cold seems to be of some importance, for in temperate climates epidemics have most often occurred in the cold season of the year and changes of temperature seem to favour their development. This might however, be due to the effect of cold in lowering the resist power of the individual. Cholera, too, is a disease subject in some degree to temperature conditions. This is shown by the rarity and mildness of the disease in Northern Europe, and its absence from Northern Siberia. The influence of warmth was remarkably demonstrated by the distribution of cholera in Russia in the year 1892. The intensity of the epidemic decreased with something like mathematical regularity as the disease travelled from S. to N. and though other factors such as a loss of virulence in the cholera virus as it travelled further and an increasing preparedness on the part of the authorities to meet and deal with the disease, may have been at work, it is scarcely possible not to believe that a diminishing temperature was the most important factor. Many other considerations, especially the subsidence of cholera in Europe in the winter and its recrudescence in the summer, prove further the great influence of warmth upon its prevalence. A warm or hot atmosphere seems also essential to
the prevalence of dengue.

Almost without exception the onset of cold weather has put an end to epidemics of that disease. Temperatures near the freezing point are said to arrest an epidemic completely. Diarrhoeal disorders also of all kinds are more common and to some extent more severe in hot countries than in warm, and in warm countries than in cold. Hot summers in any country are almost invariably associated with diarrhoea prevalence. Temperature is a powerful factor in determining the distribution of diphtheria. Extremes of heat and cold are unfavourable to its prevalence. Heat is probably more unfavourable than cold, for while diphtheria is found as a severe epidemic in no tropical country, it is endemic and a cause of high mortality in such cold countries as Norway and Sweden. This conclusion is further justified by the seasonal relations of the disease. Diphtheria in many temperate countries is found to be most active in the autumn and winter and least so in the summer months. Dysentery is another disease of which climate has considerable influence. It is more prevalent and also more severe in warm than in cold countries. Thus in Europe, not only as a whole, but in separate parts, like Italy and Spain, in Australia, in New Zealand, in Africa and S.
America it is found to diminish in both respects from South to North. It was however once very prevalent in Northern Europe and has been malignantly epidemic in Arctic Iceland. Erysipelas is a disease which both in its seasonal relations, and in its distribution, seems to prefer cold. Gondou is a disease entirely confined to the tropics and may therefore be supposed to depend directly or indirectly upon warmth for its development. Gout is a rare disease in tropical countries, and amongst ourselves exposure to cold and damp are important predisposing causes. Tropical Liver abscess, as the name implies, is a disease of hot climates; but its association with dysentery and alcoholism render the question of temperature of subsidiary importance. Malaria seems very definitely controlled in its distribution by the degree of warmth present. As Dr Clemow remarks "it is commoner and more severe in hot climates than in warm, and in warm than in cold; and from the equator to the poles there is a fairly regular decrease in both the prevalence and intensity of the disease." Mediterranean fever is a disease which has never been seen in really cold climates. Both in Europe and in America its distribution seems to be controlled by this dislike for cold.

Mycetoma is another disease entirely confined to tropical and sub-tropical countries. Rickets
again is a rare disease in tropical and sub-tropical countries.

Scarlet fever is another disease to which extreme cold and extreme heat are both inimical. It is almost unknown in the tropics and in far northerly regions it is an exotic.

Sleeping sickness is entirely a tropical disorder. Tetanus is far more common in tropical and sub-tropical countries than in the more temperate zone.

Typhus fever in its distribution shows marked relations to atmospheric temperature. It is essentially a disease of temperate and cold climates. In tropical countries when it occurs it is found at high altitudes where the temperature is low. The great majority of epidemic outbreaks in all countries have occurred in the cooler parts of the year. Whooping cough is mainly a disease of temperate and cold climates, and is both rarer and less malignant and fatal in warm and hot countries.

Yellow fever is another disease showing very definite relations to temperature. It does not occur as an epidemic disease in places where the mean winter temperature is much below $65^\circ F$. In its endemic areas it is always worse in the hot season and dies away as the cold weather advances; and it almost invariably disappears from an infected ship as soon as she arrives in cooler latitudes. Epidemics inevitably disappear when the temperature sinks to freezing point.
Altitude above sea level is also a factor of great importance in the natural limitation of disease. Communities dwelling amongst the mountains, by their elevation secure a relative or absolute immunity from many diseases. Their isolation, the effect also on the health and resistance power of the individuals and on the life of the causal organisms of disease, the freedom from impurities of the mountain air and the sparseness of the population, all tend to this result. There are some diseases like ophthalmia and trachoma to which the high pure mountain air seems absolutely inimical. Malaria and yellow fever are very rare at high altitudes, no doubt because the mosquitoes bearing these diseases are not found at such heights. A comparative immunity from such diseases as diphtheria and tubercle is the natural birthright of dwellers in the Alps, the Himalayas the Cordilleras and other great mountain ranges. They also escape in large measure such diseases as black water fever, cancer, cholera, dengue and dysentery, and all the scourges of humanity which flourish best in low lying damp alluvial regions, in the great river valleys and along the sea coast. But there are certain diseases which seem to prefer the hills. Goitre is much more common amongst hill folk than in the plains. Plague,
once thought a disease of low lying alluvial plains and river deltas, is now known to be endemic in many of the most mountainous regions of the world. Typhus in the tropics is only found at considerable heights but this is probably more a question of temperature than of elevation.

The character of the soil is also of some importance, there are certain diseases which are definitely associated with conditions of the soil, it may be as in such a disease as tetanus by actually containing the causal organism. The immunity of the Faroe Islands from tetanus may be explained by the absence of the bacillus from the soil there. The association of Goitre with certain geological characters of the soil is also very definite. It has been found that people who live on a magnesium-limestone soil and consequently drink water impregnated with these salts, are much more subject to this disease than are others. It has been suggested that the sulphide of iron or of copper usually found in such waters is the real cause of the disease. It may be, however, that the disease is due to a micro-organism and Lustig and Carle have actually described a bacillus in the waters of some goitrous districts. They have however been unable to establish its causal relation to the disease.
Calculus was formally thought to have a close relation to soils of chalk formation, but that view seems no longer tenable. Malaria is a disease whose relation to the soil is somewhat obscure. It is usually found in association with a warm, moist soil, richly encumbered with decaying vegetation. The number of severe epidemics which have occurred after disturbing such soil has been great. It is suggested that in these excavations, irregularities of the surface are formed causing pools which readily form breeding grounds for the mosquito, but possibly the explanation is more complex. Tubercle is another disease in which a definite relation with the soil has been suggested. The observation of Bowditch in America in 1862 and of Buchanan in England in 1867 show that the disease is greatly favoured by a damp impervious soil. Buchanan's conclusions were that, at least in the three counties where his observations were made, Phthisis is less common on pervious than impervious soil; that it is less common on high lying pervious soils than on low lying pervious soils; that it is less common on sloping impervious soils than on level impervious soils; that wetness of the soil conduces to phthisis in people living on it; and that no other circumstance can be detected that coincides on a large scale with the greater or less
prevalence of phthisis than the one condition of soil. With regard to Typhoid too, the observations of Pettekofler and Bühl showing the relation of that disease to fluctuation in the sub soil water are well known. The frequent occurrence of dancer amongst dwellers on clay and other retentive soils has been noted. Long continued residence on a damp soil is a well recognised factor in the causation of diphtheria. Wetness of the soil seems to predispose to such diseases as cerebro-spinal meningitis and rickets. A sewage soaked soil is frequently found in association with such diseases as cholera, mediterranean fever, plague, and yellow fever. It may also be noted that in diseases directly attributable to cereals in common use as food, the condition of the soil has an influence in affecting the growth and harvesting of the grain. It will be seen then that soil has an influence both direct and indirect in relation to disease, direct in that it may contain the actual organism or chemical constituent recognised as the prime factor in its causation, indirect in, that it may in various ways predispose to the disease.

One or two further points must be mentioned to complete the discussion of this part of our subject. First - distance from the endemic home of certain diseases. With regard to Cholera Dr Clamow remarks - "It is more than probable that
the relative immunity from cholera of countries distant from the source of the disease is due not only to their less constant and direct communication with India, but also to the greater distance over which the virus has to be carried with consequently increased chances of its dying on the way or greatly losing its virulence."

Second, the question of acclimatization is of some importance. This matter has been much misunderstood. Climate, as we have seen, affects disease distribution and also because of its influence on the individual in predisposing or occasionally in increasing this resistance to disease is a factor of much importance. These are the only aspects in which such a phrase as "acclimatization to disease" can be justified. Change of climate, by reducing the resistance of the individual to disease, may predispose to it. The dweller in the plains may suffer from diarrhoea until he gets accustomed to the change in atmospheric pressure. A change from one country to another, with its difference of temperature, food, drink, and habits may cause temporary physical disturbance. But, repeated visits or prolonged residence in the case of an individual do not "acclimatize" to the particular diseases of the neighbourhood. Miss Kingsley in her book
on W. Africa has protested against the possibility of acclimatization to such a disease as malaria; and Manson has said that what is called acclimatization is less "an unconscious adaptation of the physiology of the individual" than "an intelligent adaptation of his habits."

The same may be said of liver abscess, dysentery and yellow fever, all diseases of which the phrase is commonly used. As an illustration of what I mean take the following from G. Burnard Hoffmeister's paper on "The Influence of Race on the Course and Treatment of Disease". "Typhoid fever" this writer says "gives a typical instance of the acclimatization of the race through heredity, for in tropical regions the disease is often completely limited to strangers. During my visit to Jinjeera off the Malabar coast, I was informed that the foul water of the large tank is certain death to a European through the fever, and yet it forms the ordinary drinking water supply of the crowded inhabitants. Among such people mild cases due probably to the same poison exerting a much mitigated action are however not infrequent. In this instance time has apparently produced a modified form of the disease by a general protective process of natural infection, similar in its effects to "inoculation as well as by the all pervading action of natural
selection and accommodation to environment." It is obvious in such a statement as this that much more than mere "acclimatization" of the individual is intended, and the word "acclimatization" applied to disease, although convenient, should, I think, except in so far as it refers to the effect of climate on the individual, be abandoned.

Precisely similar statements are frequently made with regard to cholera. Let us consider for a moment this question of natural protective inoculation. Immunity can be established to certain diseases by small doses of the living virulent causal organism. But suppose a community living for the first time under such conditions as described above newly and fully developed. The children would be the severest sufferers. Adults who had not the innate germicidal power of serum, plasma, or lymph to destroy the micro-organisms and neutralise their toxines, would succumb. Pregnant mothers who were able to recover might transfer their developed protective power to the child; or the child might get the disease and successfully or unsuccessfully struggle with it. We thus find ourselves merely trying to explain how natural selection acts. Obviously from such a process resistance to the disease must be evolved
and would render a continuous process of preventive inoculation unnecessary.

We have still to consider by far the most important factor in the limitation of disease - the degree of susceptibility existing in the individual and in the race. General Tulloch I think, first enunciated the great law that certain races are immune to certain diseases. Some of these racial immunities have been accounted for by merely physical peculiarities. M. Brocca writing in 1869 ascribed the comparative immunity of Celts to varices and varicocoeils to the relatively smaller blood pressure in the smaller race. Manson has suggested that the marked liability of the Mongolian races to Ophthalmia and other eye diseases may be due to the peculiar elongated almond shape of the Mongolian eye. No doubt the immunity of the African negro from these conditions must have a similar physical basis. All racial immunities to infectious diseases must find their ultimate explanation in the physical constitution of the people - the absence of the actual physical defect which makes inoculation possible and the presence of a germicidal or anti-toxic power of the blood which renders inoculation harmless. Habits and mode of life generally have been held to explain many immunities.
Remlinger writing in the Weekly Minutes of the Biological Society of Paris ascribed the supposed immunity of the Jews to Phthisis to the fact that dry sweeping is unknown amongst them. We have seen the importance of food, clothing, housing and sanitation as bearing on this subject - how the Mohammedan escapes taenia, the European tetanus, and many other parasites, and so on. We have endeavoured to examine the natural barriers to disease in order that we might understand their limitation. We have also given due weight to all the contrivances of man to guard himself against disease. We have been forced to the conclusion that in any one or in the sum of all these, apart from the great law of natural selection we can find no complete explanation for racial immunities. In other words, - a people is immune to any disease in direct proportion to the length of time they have been in contact with it. This law holds good of all infectious and contagious disorders, but it is particularly in relation to those diseases which, taking the world as a whole, seem to have increased rather than diminished - tuberculosis, syphilis and the like - that it becomes particularly manifest. But let us emphasise once more the fact that broadly speaking it is the races recognised anthropologically as at the bottom of
the scale - the negro and the Mongolian races - which show the highest degree of susceptibility to the world's infectious diseases.

We may now consider some individual diseases in illustration of this great law. We have already remarked on the apparent amelioration of syphilitic manifestations, during the last two centuries in this country. It has been long known that amongst certain peoples the disease appears in a severer and less curable form than among others. M. Leyneau discussing the matter in the Annales de hygiene publique T. 28 2nd Series and commenting on the mildness of the disease amongst the Portugese says "Their ancestors must have paid dearly for the immunity enjoyed by the present generation." M. Lancerau writing in the Gazette Medicale Paris 1873 p. 406 on the disease as he saw it in China remarks: - "It might be said that China has undergone for thousands of centuries a sort of general syphilization which has progressively weakened the virulence of the infection in the organisms that are attacked by it." M. Blanc says that "In Abyssinia where the great porpotion of the population is syphilitic the evil is rarely serious," there is then a remarkable testimony that syphilis conforms to this great law of progressive amelioration.
Syphilis is apparently a disease of civilization. It is not found amongst primitive peoples. Both the disease itself and the vices which encourage its spread follow the soldier, the trader, and the settler. I remember a remark of Hunter's on the authority, I think, of a Russian student, that the Mongolian tribes living on the banks of the Volga are mostly syphilitic and are rapidly dying out in consequence. But in N. America, in Brazil, and the other South American States, in Siberia, Australia and Africa syphilis has been communicated to the native population by the white man and in many instances has committed terrible havoc amongst them. Of the many factors which, taken together, lead to the gradual extermination of the more primitive races when brought into contact with the more advanced, this disease is probably one of the most important.

Jonathan Hutchinson thinks that we may explain this comparative immunity in peoples long in contact with the disease by recourse to the hypothesis that second infection usually results in the production of a much milder form of the disease. I think from the point of view of the race however it is not so much a question of the long continued inoculation of the disease amongst a people as the gradual elimination of susceptible
individuals.

Tubercular manifestations may also be regarded as self-limiting by natural selection in the progress of time.

These diseases amongst ourselves are still very prevalent and a cause of great mortality; and indeed in some parts such as Ireland, seem to be increasing. But when we compare our susceptibility with that of the negro, the Chinese, and the Japanese, how marked is the difference! There can be little doubt that tuberculosis must once have been much more rife amongst us than it is. When we read such descriptions as Nansen gives of the disease in Greenland, where he says "it is so common that it was almost easier to reckon up those who were free from it, than those who had it," how the Esquimo throughout Alaska, Hudson Bay Territory, and Labrador, were perishing from it; how the Kanakus of New Caledonia, the natives of Hawaii and other Pacific Islands, the Maori of New Zealand, the Aborigines of Australia, and the indigenous tribes of Siberia are fast disappearing before it, we can understand what the disease must have been like in aboriginal Britain. One may attribute their amelioration to better housing, sanitation and so on, but anything
like a serious attack on the disease is even now only in its beginning. It is impossible to escape the conclusion that our progressive immunity from the disease is due for the most part to a gradual elimination of the susceptible human type.

The immunity of the negro and of the aborigines of the Formosan Hills from malaria is notorious and can hardly be accounted for on any other ground than that of long contact with the disease.

The negro has a remarkable immunity also from yellow fever. During severe epidemics negroes do take the disease in common with white people and die of it, but the disease in them is lighter. Dr Clamow observes that this immunity does not seem to be an acquired characteristic from long exposure to the infection through one or more generations, "giving as his reason "that in many instances negroes newly introduced into an infected city have escaped the disease." This fact establishes the immunity of the negro from yellow fever but I fail to see what bearing it has on how that immunity was acquired.

Typhoid is another disease which in many parts of the world, such as Egypt, and India, attacks the stranger more frequently and in greater vehemence than the native. This also is no doubt due
to the elimination of people with any marked susceptibility.

Cholera is a disease which admittedly is absolutely controlled in its distribution by this factor.

Of Sleeping Sickness Corre in the Archives des Medical Navale 1877 asserts "that in those regions of W. Africa where the disease is endemic negroes coming from other districts appear particularly liable to it. The local inhabitants seeming to become in a sense "acclimatized."

It appears then very generally to be true of infectious diseases that they tend to work their own cure in the history of the race. It must not be forgotten however that there are regions of the earth where the environment is so bad that this principle is pushed almost to the extinction of the inhabitants. It is asserted of the inhabitants of the Pontine Marshes that exposure through long years to the Marsh fevers has only led to their degeneration. In Mexico in the State of Tabasco where Marsh fevers are endemic it is death to the white man to turn the soil; even the native Indians have become rare.

Looking at the question now from an historical point of view, how far can we claim to have abo-
lished any one disease by our systems of isolation and public health supervision? Typhus fever is a disease regarding which it may be claimed with some degree of probability that the reduction in its prevalence is due to improvements in sanitation. The reduction of over-crowding, the opening up of the over built, over populated, filthy slums and rookeries of large cities; the provision of more space per head in gaols, reformatories, warehouses, barracks and ships have had a most powerful influence in checking this disease. It is to be noted however that although the disease still lingers only in the filthy dens and alleys of our large cities, even in these places it is no longer the dreadful scourge it once was. It may be that by our improved sanitation we have removed some of the conditions essential to the life of the causal organism. It seems to me more probable that by these measures as well as by a general rise in wages, and an improvement in the social and domestic conditions under which most classes of the population live, the general health of the people has been advanced, and so their resistance to disease increased. The provision of proper water supplies, the supervision of the construction of drains and sewers, and the inspection of food, have had a remarkable effect in reducing the preva-
lence of typhoid fever. One may well question however whether the perfecting of such measures and their more thorough application will ever rid us of that disease. Measures of sanitation, such as the provision of good water supplies, the proper draining of the soil and the use of filters, have aided in diminishing or extinguishing the disease in many parts of the world. The diminution of ergotism in recent times has been attributed to an improved knowledge of agriculture, to more careful cultivation of the crops, to greater facilities for providing the poorer classes with good and wholesome food-stuffs, and finally to increased cultivation of the potato. It is believed that the greater moderation in eating and drinking which obtains now as compared with the very different habits of our forefathers explains the diminished frequency of gout in recent times. Leprosy is a disease for which it is constantly claimed that it was in consequence of the stringent laws of the middle ages that it was stamped out in many places. It is also claimed that the isolation of lepers in Norway is causing the diminution of the disease in that country. That these attempts at isolation and segregation may have had something to do with the result need not be denied, but real isolation has never been complete and is never likely to be. In the middle ages, it is well
known, the wealthy and powerful managed to escape the pains and penalties of the law. Many of all classes secreted their friends, and lepers were allowed to wander about and beg. The diagnosis in these days moreover was by no means certain, and no doubt the early stages of the disease were frequently overlooked. In Norway there never has been any attempt at complete segregation, and even now such measures are only partial. It must be admitted however, that it is only since these measures, incomplete though they be, have been adopted that leprosy in Norway has actually declined; nevertheless this decline may have been favoured by the improved sanitation, better food and increased prosperity of the people. In the Sandwich Islands on the other hand, where the most determined efforts have been made to completely segregate the lepers since 1865, the disease went on increasing until 1890. Since then a slight decrease has been noted. We have already commented on what has been done in Holland with regard to Malaria. The malarial campaign has begun in earnest in many other parts of the world. The mosquito theory, if it has not succeeded in explaining all that is obscure with regard to this disease has led to practical results of such value that the world can at present afford to wait for a com-
plete theoretical solution of the malarial problem. In Italy direct attacks on the malarial-bearing mosquito, combined with the most careful measures to protect the individual from its bites, have already shown that even in the most malarial regions it is possible to escape the disease; and a wider adoption of these and similar measures may perhaps ere long lead to the diminution if not to the total extinction of malaria in the Peninsula. In the British possessions of the W. Coast of Africa a determined war is being waged against malaria and the effect has been most encouraging.

The hope indeed is already expressed of obtaining there a result that at any earlier period would have been incredible - the removal, that is of the eternal reproach against these shores as being "the white man's grave". It has at least been shown that although it may be impossible to eradicate malaria from W. Africa, the European may now take up his residence there with enormously increased power of protecting himself against the attacks of the disease. In Cuba and elsewhere the energetic application of similar measures is said to have already diminished the deaths from malaria in a most striking way.

It is clear then that our comparative immunity from disease may be in great part accounted for by
an improvement in the measures taken for its prevention. How far however this point of view leaves us from a complete comprehension of this great change becomes evident on the most superficial examination of the facts. Many infectious diseases appear and cause epidemics in houses and institutions irreproachable as regards cleanliness and general sanitary arrangements. Some of them indeed, like mumps seem entirely independent of hygiene. In the endemic homes of certain diseases although the native population may be living in the most absolute squalor, they are generally found to have some immunity to such diseases. The facts with regard to certain diseases which have disappeared or diminished in prevalence do not support the contention that they have been abolished or controlled by sanitary measures alone. Plague, is a disease which is associated everywhere in the world where it is prevalent - in Yemen, in Mongolia, in the Himalayas, in Persia, in Mesopotamia, in Arabia, in China, and in India, filth, misery, poverty and unhygienic surroundings. It cannot but be that the grave insanitary condition of all these regions is a powerful factor in plague distribution. Yet it is difficult to see how the various sanitary defects act in favouring the spread of plague, and it is certain that they do
not explain all the phenomena of the disease. We cannot thus account for the restriction of plague for decades and even centuries to quite limited areas, and then, without apparent reason, its world wide spread. Nor can the gradual recession of plague eastward in Europe at the end of the 17th Century and from Egypt in the 5th decade of the 19th Century be so explained. There has been remarkable improvement in the sanitary condition of most European countries since the Middle Ages. No doubt this change for the better is the reason why Plague in recent times has been unable to get a serious foothold in Europe, but no great and startling change took place in the sanitation of Europe at the end of the 17th Century to account for the disappearance there of plague; nor was anything of the kind observed in Egypt or Constantinople to explain why Plague died out in these localities in the middle of the 19th Century.

Again, improved sanitary conditions and especially increased care in isolating patients in hospitals have certainly seemed to be of value in England in lessening the mortality of scarlet fever and perhaps its prevalence also; and it is probable that they have had the same effect in other
countries. But scarlet fever appears to have periods of increased or diminished prevalence independently of those conditions, and the recent reduction of mortality from the disease in England and elsewhere cannot wholly be ascribed to improved sanitation or to the increased use of isolation hospitals. The fact is, infectious diseases which own a world wide sway yield to no factor in their distribution except that of individual susceptibility.

Admitting then that the evolution in sanitation has been of the utmost importance in checking the prevalence of many diseases, the fact is of great significance that this has been accomplished in some degree by effecting the multiplication and diffusion of the causal organisms, more perhaps by limiting the possibilities of contagion, but most of all by improving the public health and so increasing the resistance of disease.

We may now summarise the reasons which have been given in explanation of racial immunities from disease. Peculiarities of physical structure explain some; a few are accounted for by differences in food, habits, and mode of life, national and personal. The natural or artificial limitation of the distribution of the causal organisms also plays a large part. Acclimatization, inocula-
tion, - natural or artificial, - readiness to take precautions are all of the utmost importance to a complete understanding of the problem. Above and beyond all these however, must have been the action of natural selection and heredity. Disease seems to me nothing but Nature's demand for a perfect organism living instinctively in obedience to its own laws. The presence of infectious disease implies imperfection of structure in that there must have been a point of inoculation, imperfection of resistance power if the disease does not remain merely local in its manifestations. Thus nature tests her products and is satisfied only with the absolutely perfect from the point of view of her purpose with regard to the race. Here there is no question of utility, except in so far as the perfect must be the highest expression of the useful.

If one looks at the question from the point of view of Nature as a whole, it will not be denied, I think, that disease must have been a controlling factor in the history of life from the beginning. One cannot conceive even in most primitive organism as exempt from disease either because of imperfections in its inherited structure, or acquired weakness. It is reasonable therefore to suppose that disease, - the greatest
agency in the limitation of life, - must have been a most potent factor in the evolutionary process. Darwin commented on the great power of disease by epidemics to keep any particular species from becoming overwhelming. But nothing has struck me more in the course of a wide study of this subject than the general absence of comment on the part disease has played in the history of life.

Disease has surely done much more than merely limit. I think if one could see with the imagination of a Dante the great drama of life from the beginning, far beyond all the other forces making for progress would appear disease. For side by side with the evolution towards perfection of external form has gone on this inexorable testing of every organism in its intimate constitution. The lower forms of life seem to have existed primarily in order that the higher should be impelled towards perfection and compelled to live in conformity to natural laws.

We know little of the great struggle of plant life with disease. Abnormalities of structure, vices of growth and development, and epidemics, probably played as great or even a greater part in the early as in the later stages of the history of life. We have some historical instances in later times which suggest that this must have
been so. In the history of the coffee tree in Ceylon we have one of the most remarkable known to me. The whole of the coffee industry in that country was destroyed in a very few years in spite of all that Science could teach the planters, by a fungus called the himalaya vestritix. Now the coffee tree has for long been known to exist in the jungle in Ceylon, and is immune to the fungus. Here then is the most elementary expression of Nature's method. Only that organism which is perfect after its kind shall be allowed to survive and reproduce.

Some few facts, too, have been discovered in the laboratory with regard to the immunity of animals from disease. The immunity of the hen to tetanus is instructive. Pasteur accounted for this immunity by the discovery that the normal temperature of the hen was higher than that at which the tetanus bacillus can be grown. But if that is the explanation the normal temperature of the hen has still to be accounted for. One may vaguely suspect that this and other known facts with regard to animal immunities from disease, can only be accounted for by a struggle at some period in the history of the species with the particular organism in question. I have little doubt, could we explore the whole of animal life in this relation, disease species would be as striking and as various as external forms. Every new species as
it appeared must have had to do battle with the forms of life lower in the scale, not only with tooth and claw by strength or by swiftness or by any other quality useful in resistance or in escape, but by the innate perfection of its organism. Lurking in the wild beast's lair are the unseen subtle foes which will poison its wounds and steal its life, thus rendering its victory or escape fruitless. Thus the development of resistance to disease becomes an important aspect of the merely phisical struggle for existence; and as the higher forms of life are reached, the importance of this resistance power against disease is increased. Of infinitely more value to humanity than all the costly armies and navies of the world is a gastric juice of sufficient intensity to destroy the cholera bacillus, and lungs immune to tubercle.

Concerning humanity it is not disputed that natural selection is the great power at work amongst savage men in their relation to disease. Certain disease species, also, as we have seen, are commonly recognised amongst human beings, all produced by a struggle against the particular organism with which they have come to contact. With regard to a few diseases, too, it is admitted that the question of individual predisposition is the essential factor. In cholera, perhaps we have the most striking example of this fact. It is a well recognised fact that in the most violent
epidemics of Cholera a very large proportion of the population - some say as much as 90% - are protected through their constitutional immunity. Dr D.R. O'Sullivan writing on the Hamburg Epidemic of 1894 says: "The decline of the epidemic is due, not to any medical skill, but to the fact that the disease has weeded out all the persons with the necessary predisposition."

Hart and Smith, writing on Cholera in Albutt's Medicine, page 372, remark: "The habits of the people, and the condition of the water supply of many Indian villages is such, that if one does not bear in mind that a necessary factor in the etiology of Cholera is the susceptibility of the individual one might expect the whole mass of the inhabitants to perish rapidly of the disease."

The behaviour in epidemics of certain other diseases also suggests the great importance of personal susceptibility. With regard to Measles, Dr Ulemow remarks: "When it has been imported to Iceland and to the Hudson Bay Territory it has raged with terrible violence. In these epidemics the disease appears to prevail until it exhausts all the available material, and then to remain absent until it is imported again."

Scarlet Fever also when introduced into an isolated community appears to die out after exhausting all the available material, and a re-importa-
tion of infection, and of a fresh generation of susceptible persons are needed before the disease can recur. One might still further elaborate this matter, but it is not necessary. It is noteworthy, however, that there is no known infectious disease of which it is not postulated, that certain persons are immune to it.

Let us emphasise once more the remarkable comparative immunity of civilised communities from infectious diseases, although the conditions of life are such as to render infection easier. Our great cities with their crowded theatres, public meetings, restaurants, trains and busses, are no longer disturbed at all in their work or in their pleasure by the advent of the most deadly disease of diseases. Looked at more particularly how wonderful this immunity is. There are British children who can harbour the active bacillus of diphtheria and show no sign of illness. The diplo-coccus of pneumonia is carried with perfect comfort in the throat by many people. As physicians most of us in the course of our work have come in contact with many infectious diseases, some of us have lived in hospitals for consumption, and infectious disease hospitals, and have worked for hours a day in crowded out-patient departments breathing the "contagium vivum" of a mixed infection - a very nightmare to think of. Yet how
few of us suffer at all in consequence. In general terms, then, civilised and savage peoples differ in their relation to infectious diseases in that in the former a relatively smaller number of people are attacked, the character of the resulting illness is much more various, and the malignant types are the most uncommon.

We have endeavoured to account for this great evolution by attributing something to causes affecting the distribution of the causal organisms of disease, but far more importantly to causes affecting the susceptibility of the individual. We have been forced to the conclusion that racial immunity must have been acquired by natural selection and inheritance - by the transmission of an ever greater perfection of intimate structure and germicidal power of blood. We have seen how all important bacterial diseases must have been determining the existence of species, and how long continued exposure to an infection tends to establish a racial resistance. It has been impossible to account for this except by supposing that imperfect individual variations have been slowly eliminated by the action of natural laws. We have of necessity in this thesis dealt almost exclusively with infectious diseases. It has recently been remarked in many quarters that a gradual transference is going on of most diseases
to the parasitic class. Indeed the number of diseases directly attributable to non-living matter is exceedingly small. Quite recently with regard to a group of diseases, for long thought to be caused by the mechanical irritation of different dusts, it has been questioned whether these alone are a sufficient explanation. It seems to be admitted that the purely mechanical action of an aseptic foreign body in the tissues will not result in inflammation. There are many disease conditions such as those produced by the mineral acids and poisons, which seem only indirectly associated with the action of micro-organisms. Still, disease is a living process, and it seems only reasonable to suppose that, in all probability it may generally be attributed to a living cause.

It is often asserted that the higher the form of civilization the less the influence of natural selection. Many recent writers have eloquently urged upon us the need for the recognition of racial considerations in all our humane and philanthropic work. It seems to me that the fear of producing racial degeneration by interfering with natural selection is groundless. We are in almost complete ignorance of nature's ultimate aim with regard to humanity. It is indeed perfectly certain that, be our endeavours what they may, that end will be accomplished with, or in spite of
our aid. Natural Selection seems to me an all pervading law of life as much as gravitation. One can hang one's hat upon a peg, or wire the petals of a rose, but we do not thereby claim to have abolished gravitation. The veriest cripple in Whitechapel, saved from an early grave by some philanthropic hospital, may be a more valuable citizen of the world from nature's point of view than the finest West African warrior. In any case, Nature with infinite ages in which to work out her purposes cares not whether we preserve for a few generations an unstable type. It will ultimately most certainly die.

We have been told recently that the most terrible degeneration is coming upon our people. It seems to me that this is only most welcome evidence of our fast awakening public conscience. No comparative figures exist so that it is impossible to dogmatise, but I cannot believe that could the facts be ascertained for several successive generations anything like a progressive degeneration would be discovered. It seems to me inconceivable that the average British child born say in the filthy immoral disease ridden England of the Middle Ages could compare in its chances of life, its immunity from disease, or in its ultimate physical development with the same type to-day. It is true a greater proportion of our
people live in cities than was the case at that time. City life however is not necessarily antagonistic to perfect physical condition. It is only in so far as cities have been for ages the hiding places of squalor and intemperance, hunger and insanitation, that they have influenced at all the physical fitness of the people. Surely in these matters the cities of the 20th Century are as far removed from those of the 15th as our motor cars are from their stage coaches. The national fright about our degeneracy is due to many causes. The vastly increased exigencies of our national life, the growth of wider views regarding national well being, and the intolerance they have produced of every condition inimical to a healthy state, the increasing thoroughness and efficiency of every branch of the public services, - particularly those dealing in any way with this question have led to the exploration of many of the dark places in our land. Compulsory education has brought within our reach thousands of children hitherto uncared for. The increasing demands of an ever widening Empire upon our army and navy have led the recruiting sergeant into regions before untried. There has thus been forced upon our notice the condition of the children in our schools, and of the young men of the slums. There has been dragged into the light by that power which
is behind human progress, the fact that there exists in our midst a mediaeval England ignorant of the most elementary laws of health, whose citizens by the very conditions of their birth, and rearing, are foredoomed to every ill that flesh is heir to.

It is in consideration of how to deal with this problem that the burden of disease as it affects the race comes home to us. It must be admitted that we have not yet succeeded in utterly abolishing any one disease. Still, the increasing efficiency of our Public Health Administration, the glorious work of our Hospitals, above all the growing intelligence and disease knowledge amongst the masses of the people - not so much in their treatment of individuals as in the appreciation and adoption of the principles of healthy living - must increasingly have this effect. Vaccination may with justice be claimed as one of the greatest triumphs of humanity over disease, and yet vaccination has not anywhere abolished small-pox. Indeed it seems impossible that it should ever do so. So many factors enter into that question. Our Legislation is permitting numbers of people to go unvaccinated. Re-vaccination is practised only in times of alarm. But there are further points concerning the perfection of the lymph, the thoroughness of the operation, and
to this unfortunately must be added the undeniable fact that there exists a body of medical men sceptical on the matter of vaccination, and indeed only performing it in obedience to popular demand. It is clear then that while our immunity from smallpox depends upon vaccination we can never hope to be quite done with the disease. Fierce outbreaks will occur from time to time during which even the vaccinated will not altogether escape.

With regard to diphtheria it is commonly considered that that disease is increasing both in morbidity and in mortality. I think that conclusion is scarcely justified. The increase which the Registrar General's Returns show up to 1893 may be accounted for without being forced into that pessimistic belief. The increased number of children who attend school, for instance, must have had an important bearing on the figures. There has also to be taken into account, the improvement in the bacteriological facilities for diagnosing the disease. Since 1893 a reduction in mortality has been noticeable, owing no doubt largely to the serum treatment of the disease. When this treatment has been universally adopted and not reserved for severe and otherwise special cases a still greater decrease should become apparent. But very certainly serum therapeutics
can never rid the race of any one disease. Indeed the power of drugs to cure disease even in the individual is very limited. We are too often but the interested spectators in a battle royal between the forces of the organism and those of disease, and rarely indeed can we alter the result.

It seems then that the ultimate cure of disease in the body politic also must be accomplished by the inexorable working of natural law. It is matter for great congratulation, however, that amongst ourselves at last a national conscience is awake. We feel the burden of our sick, and it is being realised that, by the more thorough application of what we already know regarding the laws of health as they affect the pregnant mother, the suckling at the breast, the child in its earliest years, and at school, and the adult in the full discharge of the responsibilities of life, much might be done to lighten it. If it be true that disease is merely the result of some imperfection of the organism either inherited or acquired, which gives a chance to the lower forms of life, the outcome being directly in proportion to the susceptibility of the individual, we have only two methods of attack. The conditions of life must be made such that in every conceivable way the resistance power of the community to disease may be augmented. The laws of repro-
duction must be constantly preached so that we may obtain at last an instinctive intelligent obedience to them. The suggestion that restrictive legislation should be tried seems to me a mistake. Such legislation could have no element of permanence and many would find means to evade it. After all, man is an intelligent animal, and in the end obeys instinctively those laws of life which by an accumulation of concrete instances have been proved to be for his own good. In other words nature gradually secures man's co-operation in her efforts after the perfecting of the race.

Meredith has frequently expressed his belief that nature has not failed with humanity. Metchnikoff in his recent book "The Nature of Man" speaks of a time when disease shall be no more, and man will die by what he calls "an instinct for death". We may also humbly accept it as a faith that Nature will ultimately conquer disease. It seems to me the veriest insanity of unbelief, in face of the known history of life upon the earth to question progress, or to limit it.

Who shall say that in time Nature may not get rid of the physical scaffolding she has used in the building of man's personality? Are there not signs already that the body must become less and less useful? Does not every advance in human
power over the physical universe seem to steal some one or other of the body's functions?

When we think of the extraordinary increase in the rate of living during the last 50 years, one cannot in one's wildest imagination conceive what life will be like in a century or two. It may well be that at length some strange new spiritual species will appear upon the earth. Mortality shall then have put on immortality. The Universe will be man's playground; and the planets his stopping places.
APPENDIX
P. 12 "Si les Indiens ou les matelots qui étaient revenus avec Colomb avaient rapporté la maladie Venerienne, ils n'auraient pas pu cacher les symptoms de ce nouveau mal, qui dans ce temps paraissaient en peu de jours au visage, avec une déformité hideuse et de très vives douleurs. On s'en serait aperçu à Lisbonne et à Valparaisos, ou ils venirent pour être présentés à la cour."

EXAMEN HISTORIQUE DE LA MALADIE VENERIENNE. (1777)
en Europe par A. R. Sanches M.D.

P. 77 etc.

"Petrus Pintor, Hispanus medicus (writing 1496) Valentia natus ... de lue Venerea aut primus omnium scripsit, aut certe inter primos .... Ait enim ab anno 1494 usque in præsentem annum 1496 quidam morbus ignotus, diversis dolorum speciebus, in diversis membrorum corporis partibus, pustularum modorum, in magnitudine et parvitudine, in certe corporum hominum nascentium, terribiliter gentium multitudo et parvitudinem cruciavit, qui a vulgo Romano Gallicus morbus vocatur.

... inquit mercuriali unguenti se inungere voluisse
Reverendiss D. Cardinali de Seguorbia, qui hunc morbum patiebatur cum terri terribilibus et fortissimis doloribus, qui die et nocte, praecep in lecto quiescere neque dormire poterat, stante tanta fortitudine dolorum et ad syncopem portarent, ex quo secatam in somnietatem et suffocationem magnam in partibus gutturis et oris Et paulo post, virulentiam materia nonnunquam velut caverosam exaggerans, eam inquit visam in Petro de Borgia, in quo virulentia materia pustulanam capitis corrosionem in pellierane et craneo manifesti fuit."

Demum unguento quod habeat anungiae porci recentis uncias tres, terebenthinae de Pino, Lithargyrii auri, lerussae una unciam unam, olea Laurini uncias sex, Luci Acetositatis citri quantum sufficit ut fiat unguentum liquidum.

(M. Cutterino a obblie le mercure crud, dont la dose était de trois gros, comme on le verra di-apres.)

**HELIE CAPREOLI.** De rubus Brixianorum

Sed inter caetera haec universalis fuit et monstrosa pernicies; pustula pustulenta, magnitudine Lupidini crassierio, in orbem extensae, cognationis praemuniae; in artubus pruritus et dolor tristis; febris accensa vehementuis; cutis foedis exasperata crustulis afferebat intumescantibus undique tuberulis, quibus rubor, primo lividus mox nigricanus color apparebat.
Post dies aliquot ab ortu, admixto sanguine humor exprimebatur; capitula spongolias diceres, exhausta liquori. Quadriennum in aliquibus excessit, obducta cuti cicatribus, illius sedem indicantibus. Ab inguine mulieribus, a glandi viris saepius incepit; mox per universum corpus vagabatur. Senere id malum prae- sertim incontinentes; contactu tamen inficiebat quoque vicinos. Audivimus omnem fere terrae orbem invasisse genus id contagionis morbum Gallicum nuncupatum, quem hactenus ut elephantiasin ante Pompeium Magnum et ante Tiberium Claudium mentagam, Italian neutiquam credit passa.

A. R. Sanches.

P. 99 Tous s'accordent à dire que cette maladise montrait d'abord par des boutons purulents au visage; qu'elle était accompagné de douleurs par tout le corps; le peau parsemée de croutes avec une fièvre continuelle et aigue; qui cette maladie se communiquait non seulement par les actes vénériens mais aussi qu'elle infectait ceux qui approchaient aux malades, qui cette maladie n'était devenue générale que lors de l'origine de cette épidémie; que plusieurs malades mouraient subitement, que la plupart en était attaquée sans avoir en commence avec le sene . . . .

Pintu, et bien d'autres médecins sur la fin du 15 siècles l'ont assuré et dimentu par leurs observations; et que ceux qui étaient infectis de cette maladie jusqu'en 1500 étaient pas des ni accusés de débauche ou de dissolution dans leurs moenas
PETRUS DELPHINUS VENITI GENERALIS CARNALDUTINUS.-

Epistolarum Libri. V. 20 ix 14. 96.

Medicamentum Morbi Gallici quod petisti . . ad te mitto; transmissum et mihi a medico qui Hospitalis Florentini curam gerit, et mei est amantissimus, qui me mosque infumitate constituto saepius amavit; si profuerit remedium tuis, bonum opus feceris, neque alienum ab Episcopati cura.

Nam unis homo potest inficere homines conversantes et stantes cum infecto; etiamque potest inficere aerem camerae et domum ubi habitant. Et si pertransit de uno homine ad alium et de uno domu ad aliam inficiunt hominis illius civitatis ex hoc contagio (ainsi la verole a ce commencement était en tout semblable à la peste) . . . . Nos tamem in patientibus hunc morbum plurimum vidimus contigisse in isto tempore, quod hic morbus cruciebat per contagium, praecipue cum muliere hoc morbo infecta.

Cap. ix In civitate Romana in pestilentia anni 1493 (ab init August for six months and more) . . . . sed tamen in primis tribis mensibus fuit Tertis pestilentia et post diminuo valde procedit in alius tribus mensibus, et nuncquam radix inferior fuit conjuncta radice superiore, sed semper illis mensibus dictis a radice superiore coelesti pestis in hominibus urbis Romanae influxe in et duratura stetit et lente processit et
non est toto definit effectum facere suum usque ad mensem Junii 1494, in quo mense oestis invasit multum gentem hujus civitatis.

Post radix inferior radice superiori conjunctus fuit; quia totum mensem Maii pluviae magnae effectae fuerunt in superficie terrae; etiam in visceribus ejus putrefactis et corruptis causata est.

... Ex qua multarum febrium putridarum continuarum diversarum specierum generatio stetit et accidentium terribilium, in dictis febribus innumerabilium invasis.

P. 87 SEBASTIAN D'AQUILLA dans son livre "DE MORBO GALLICO" parle ainsi de cette maladie.

"Ut nos in hoc morbo ... non enim apud omnes in pudendis incepit; inio alias is morbus erat lethralis, etiam cita morte ... Doctiori Serenico Medico referente ex malignitate materiae facientis morbum: hos tum hodie rare accidit, quibus jam clarum est omnibus morbum dictum vulgo Gallicum esse Elephantiasin."

... on peut voir que cette maladie était en tout semblable à la peste la plus et que dans ces circonstances on ne pourrait pas observer les symptomes veneriens dans les parles de la generation symptomes qui paroissent ne s'être montrés que quand la maladie est devenu moins mortale."

(N.B. There was a terrible drought in '90, followed by awful frost in '91 and '95 bringing famine etc)
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