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(E. F.)



The Relationship Existing Between Human and Bovine Tuberculosis.

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A STRANGELY interesting phase of the study of phthisis is that presented by the disease in living beings. In the human race the afflicted are generally the most attractive members of society. Scrofulous females are usually among the most beautiful people we meet, with their transparent complexion and large languid eyes, while the scrofulous males are either intensely intellectual or correspondingly erotic. The same rule holds good in the bovine race; the small inbred tubercular Jersey is in appearance the most attractive of any of the cow tribe, while even the common scrub cow that is tubercular has a certain beauty that distinguishes her from her more robust sisters. I know a famous animal painter who will always unconsciously select from a herd of cows the scrofulous one for his study whenever he makes a study of a single animal from a herd.

This is not the only strange feature of the disease. No one seems to be afraid of it. For

years men of undoubted scientific ability have been proclaiming to the world the still hardly recognized fact that bacillary phthisis is contagious, but the human family take little heed. Furthermore, the individual, sorely afflicted, beyond human aid, and shortly to die, is not convinced of the fact, but, with the same strange fatality that surrounds the disease in all its phases, the consumptive is still hopeful and imagines he is getting better even while he is dying.

This insidious and delusive disease is not the result of civilization, as many suppose. Barbarous and uncivilized races are afflicted as severely as many of the most advanced civilized races. Neither geographical position nor climatic conditions are a factor in the distribution of pulmonary phthisis, notwithstanding that our best workers in the study of the disease attempt at times to account for its prevalence in certain localities by reason of temperature or other climatic conditions. Nevertheless, every known part of the globe, with a few isolated areas excluded, is a habitat of the disease. After several years of close study of the affection, and consulting all accessible statistics and the habits of the people where the disease prevails, the only constant associated factor is found, in my opinion, in the inbred bovine species, without any regard to the social position of a community, its geographical habitation, terrestrial or atmospheric condition. If a community is closely associated with inbred dairy cattle, tuberculosis prevails.

This position which I take is susceptible of strong proof.

In establishing my proof I will first draw your attention to some barbarous races of Africa. Speaking of the natives of South Africa, P. L.

Simmonds, in his book on "Animal Products," says: "This people delight in horned cattle of the bovine species," "the natives are great milk drinkers," "these barbarous people suck the blood from the jugular vein of the living bullock," and also "churn together blood and milk for a drink." Professor Low, in his "History of the Ox," tells us: "In the vast regions of southern Africa, peopled by tribes of warriors and herdsmen, cattle abound and multiply, and form the wealth of little communities. The Hottentots, while yet they had a country they could call their own, were rich in this kind of possession." In Hirsch's book on the "Geographical Distribution of Phthisis" we find the following: "In Cape Colony phthisis is oftenest met with among the Hottentots inhabiting the plains near the coast." In proof of the fact that these African cattle are inbred, we have the writings of Anderson, quoted by Darwin as follows: "The Damaras take great delight in having whole droves of cattle of the same color, and take great pride in their oxen in proportion to the size of their horns. The Namaquas have a perfect mania for a uniform team, and almost all the people of southern Africa value their cattle next to their women, and take great pride in possessing animals that look high-bred." Darwin, from whose "Animals and Plants under Domestication" we take this quotation, adds in his own words, "As numerous breeds are generally found only in long-civilized countries, it may be well to show that in some countries inhabited by barbarous races, who are frequently at war with each other, and therefore have little free communication, several distinct breeds of cattle now exist, or formerly existed, at the Cape of Good Hope.

Lignat observed in 1720 three kinds; at the present day (1868) various travelers have noticed the difference of the breeds in southern Africa. Sir Andrew Smith several years ago remarked to me that the cattle possessed by the different tribes of Kaffirs, though living near each other under the same latitude and in the same kind of country, yet differed, and he expressed much of surprise at the fact.*

These facts relating to the cattle-breeding propensities of the negroes account for the statements of Daniell, that "phthisis is widely prevalent and very malignant among the negroes of the west coast of Africa." In the interior plateaus of southern Africa phthisis, however, hardly ever occurs. This immunity can be accounted for by the presence of the tsetse fly. This fly inhabits well-defined regions in central Africa, and where it exists, cattle, horses, and dogs can not live.†

Let us now take the civilized inhabitants of a colder clime, and we find that in Denmark, one of the noted dairy countries, there are 1,470,078 cows to 2,033,959 inhabitants, or one cow to $1\frac{5}{14}$ inhabitant. The mortality from phthisis in that country ranges from three in a thousand to 2.1 in a thousand. Now Iceland, an island belonging to the King of Denmark, where the climatic conditions are nearly the same, has 20,000 cows to 80,000 inhabitants. There are no definite statistics about this, but taking the most trustworthy accounts of the island as a guide, this is about the condition of affairs. The people of Denmark

* Guiol says that consumption is not uncommon among the colored races, particularly the Kaffirs. Guiol, "Archives gén. de médecine," November, 1882, p. 329.

† Wallace, "The Geographical Distribution of Animals," 1876, vol. I. p. 945.

are well to do, and can use for themselves more of their dairy productions, while the poor Icelander pays his rent with his dairy product. With the exception of milk, the Icelander uses very little from his herd for food. In several accounts of travelers in that country giving a description of the entertainment extended to them, I never find beef in a single instance, while in the winter nearly all the milk used is obtained from the sheep. Owing to the short hay crops, the cows are fed in winter on dried fish, and consequently the cattle will not give milk on the same low diet as the sheep do. With all these modifying influences, and only one cow to four individuals, the rarity of phthisis in the island can be accounted for, if my theory is correct. That the disease is rare we know from the writings of Schleisner, who says: "According to the unanimous testimony of practitioners on the island, consumption does indeed occur there, although remarkably seldom. In my own practice I have most carefully examined every patient who complained of even the slightest trouble in the chest, and out of three hundred and twenty-seven persons suffering from chronic diseases of the organs of respiration, I found only three with phthisis." Evans says that "this statement is borne out by the more recent writings on the state of health in Iceland by Leared, Hjaltlin, and Finsen. It would appear that it is not with any national peculiarity that we have here to do, from the fact that Icelanders who migrate to Denmark fall into consumption not infrequently."*

Now let us look into the affairs of a little island in the Atlantic Ocean as they existed

* Hirsch, "Handbook of Geographical and Historical Pathology," 1886, vol. iii. p. 177.

sixty-eight years ago. It will be remembered that in my former paper on this subject I made the statement that asses and goats were not tubercular animals. The following is quoted from "A Description of the Island of Saint Michael," by John W. Webster, M.D., 1821: "Every family in Saint Michael has one or more asses, which are the principal beasts of burden in common use, subsisting on the coarsest kind of food; the females afford considerable milk, which is sold to sick persons. Although the island is so well stocked with black cattle, sheep, and goats as to allow considerable exportation, few of these belong to the peasantry. Cows are mostly attached to the estates, and the peasant who hires a farm, in addition to a certain quantity of work to be performed for his landlord, is required to take charge of these, and convey the milk, butter, and cheese to town, where they are sold for the benefit of the *morgado*, and the poor peasant receives no other recompense for his trouble than some slight abatement in his rent. The milk is carried to town in skins, on the backs of asses, but from the agitation it undergoes, on its arrival most of the families in the city prefer using the milk of the goats, herds of which are kept in the vicinity, and daily driven into town and milked at the door of the customers." Dr. Webster adds: "Although the climate of St. Michael can not be safely recommended to a consumptive patient, it is, nevertheless, rare to see the disease in a native." Dr. Webster would not have been astonished at this condition of affairs had he realized the truth that phthisis is a disease acquired from the bovine race, for it is a fact that the only people on the face of the globe who enjoy an absolute immunity from phthisis

are those who are not in possession of the domestic cow. Take, for instance, the Kirghiz on the steppes of Russia; these people consume large quantities of mare's milk and eat the flesh of horses and sheep; but they have no cows. According to Dr. Neftel and other authority, a case of phthisis among these people was never known.* Likewise, the Esquimaux also enjoy immunity, because they have domesticated the reindeer, not the cow.

But this allusion to the Esquimaux does not apply to those who inhabit Greenland and that part of the Danish dominions in the Arctic region. There are Esquimaux that know not the cow and there are Esquimaux who have domesticated the cow. So there are authorities that state that the Esquimaux are exempt from phthisis, and other authorities equally as positively state that "consumption is common"† among them. Thus, in the government list of mortality for the province of Julianshaab, "forty-six persons died (out of a population of 4,115 Esquimaux and mixed breeds) of diseases of the chest, which include phthisis, pneumonia, bronchitis, pleuritis, etc."‡ This prevalence of tuberculosis is perfectly explained by the facts given in Dr. Hayes's book, "The Land of Desolation."§ He writes in his visit to Julianshaab: "Around the lake were extensive pasture grounds, upon which were browsing a herd of cows. . . . At this I was not a little surprised, for, although I knew that in former times cattle had been reared here in great numbers, I had received the impression

* Maydell, quoted by Williams.

† Williams, "Influence of Climate in Pulmonary Consumption, p. 17.

‡ *Ibid.*, p. 16.

§ Dr. Hayes, "Land of Desolation," p. 36.

that at the present time they would not thrive. Mr. Arthur informed me there was no difficulty in raising them, except the very important one of forage for the winter, for at Julianshaab the grass never grows high enough for hay; further up the fjord, however, it is abundant. But since the hay must all be brought in boats, it was both a tedious and expensive operation to gather it. Yet he managed to keep three cows, the governor had an equal number, the doctor had two, others had each one; and, indeed, all the well-to-do people in the village—Danes, half-breeds, and the better class of Greenlanders—had a daily supply of milk the year round." Therefore, according to this testimony, the average of dairy cattle in this community is higher than in many better-known localities, and the prevalence of phthisis is not at all surprising.

Now let us look at a locality which once enjoyed immunity but now is notoriously a place of consumption. Wallace, in his work on "The Geographical Distribution of Animals," tells us that Australia was the poorest zoological region on the globe. A story is told by Simmonds as follows, which illustrates the scarcity of animals in this region: "Mr. Oldfield, who has seen so much of the aborigines of Australia, informs me that they are all very glad to get a dog, and several instances have been known of the father killing his own infant in order that the mother might suckle the much-prized puppy." The only animals that existed in this island before its invasion by Europeans were, according to Wallace, a few marsupials. Previous to 1788 no ruminants existed in Australia. In that year 1,030 convicts and sailors were landed; they had with them as public stock one bull, four cows,

one calf, one stallion, three mares, and three colts, In 1790 provisions gave out, and they were obliged to kill all the live stock they possessed. In 1796 two bulls and three calves of the Cape of Good Hope breed were introduced, but they escaped and fled into the interior, where they were lost for several years. During this year several attempts were made to introduce European cattle, but they all died on the passage. In 1807 the Government had a herd of cattle in the colony, and cows were worth \$400 a piece. In 1821, the Government becoming convinced of the great advantages of Australia as a grazing country, emigrants were allowed a grant of from five hundred to two thousand acres of grazing land, and rations from the King's stores were also allowed to each settler; a certain number of convict servants were likewise apportioned to them. They were also allowed a certain number of cattle from the Government herd, and a loan of money to be repaid in seven years. This was the beginning of the cattle raising in Australia. It proved so successful that in 1826 the Australian Agricultural Company commenced its operations, which was the origin of the "*sheep and cattle mania*," and, as the historian puts it, "the priest forsook his altar and became a herdsman of cattle." A drought, beginning in 1827 and lasting for three years, cured the mania. But within a year after the drought, cattle became so plentiful that the meat of the best quality was sold at a cent and a half a pound. In 1833 good cattle could be bought for \$4 or \$5 a head. At the present time, or according to the last consular reports, there are three million inhabitants and eight million cattle—nearly three animals to each individual. This great increase will be seen by

the foregoing to have taken place within sixty years. Australia enjoyed a reputation for immunity from consumption and the favorable influence of its climate on the course of the malady, but, as Hirsch says, "this has of late been shown to be a mistake. In Victoria," he continues, "where the disease, it is true, has been a good deal more common *only in recent years*, the mortality from phthisis in 1866 was 6 per cent. of the mortality from all causes, while in Melbourne itself the death-rate rose between 1865 and 1869 from 2.22 to 2.52 to a thousand of the population. In New Zealand phthisis has made frightful ravages among the Maoris, and has been one of the chief causes of the gradual extinction of that race." In my opinion, the death-rate from phthisis will keep on increasing in that locality if the breeding of cattle is not properly regulated by law. We know from other historical facts that cattle can be raised without this great danger, because Hirsch and others tell us that in the Hebrides,* the Highlands of Scotland, and North Wales consumption is remarkably rare. The rarity of the disease in these localities is accounted for by Darwin's observation while he was studying the conditions of cattle under domestication. He says: "So with the mountain cattle of North Wales and the Hebrides it has been found that they could not withstand being crossed with the larger and more delicate lowland breeds. Our *improved* heavy breeds of cattle could not have been formed on mountainous pastures." Now, any one who has paid much attention to the history of cattle breeding knows that the improved races, as we

* MacCormac, "Brit. Med. Jour.," 1868, ii, p. 571.

understand them, are the result of the closest inbreeding. The rarity of the disease in mountainous countries also explains the following quotation from Hirsch: "Few countries of Europe enjoy, on the whole, so favorable conditions as Switzerland in respect to the infrequency of consumption, the figures for the entire country, according to Müller, being 1.86 in a thousand. In studying, however, the statistics of the different cantons, we find the mortality ranging from 3.57 to only 0.81. We know that there are localities in this mountainous country where Darwin's observations respecting mountain breeds would explain this condition of facts. The number of cattle in Switzerland is 1,210,849, and the population 2,906,750, or one animal to $2\frac{4}{9}$ inhabitants. Of course, too, there are regions of Switzerland where only the goat can range. We find from the official returns* of 1866 that there were 375,482 of these animals in that country, and we know, from the reports of travelers,† that the milk from the goat is used exclusively in some localities.

Having considered the conditions of some barbarous and some civilized communities, let us look at the semi-civilized tribes of Madagascar. Both Hirsch and Evans,‡ quoting Grenet, say that in this island consumption is as common as it is in any part of Europe, and rapidly fatal. We have no statistics of the numbers of the population or of the cattle, but all the writers who have visited the country speak of the enormous herds of cattle, and say that the principal diet of the natives is meat, milk, and rice. The

* Simmonds, "Animal Products," p. 56.

† Prime, "Letters from Switzerland," p. 44.

‡ Hirsch, *op. cit.*, vol. iii. p. 186.

principal occupation of the Malagasy is the raising of cattle, thousands of which are shipped to the other islands in the Indian Ocean. In fact, the Island of Mauritius, with its mixed inhabitants depends entirely on Madagascar for its meat supply. The Rev. William Ellis, describing his trip from Tamatave on the coast to the capital, a distance of about three hundred miles, tells us of the natives presenting him, at the end of every few miles' journey, with a bullock, while the Queen herself, as a token of friendship, presented him with eleven. He also adds that the natives never skin their animals, but cut them up and eat the hide as well as the meat.

We have well-authenticated statements respecting another semi-civilized race, the natives of Great Kabylia, who, according to Hirsch and Evans and other authorities,* enjoy an almost absolute immunity from phthisis. According to the best authorities I could consult as to the history of the people, there is no evidence of the presence of the bovine tribe among them, but they possess large flocks of sheep and goats, and each family has usually one buffalo ox to do the plowing.† As these are a peculiar people, with peculiar ideas and peculiar habits, not calculated to encourage visits from European invalids, they retain their immunity from phthisis to the present day. But not so with their neighbors, the Algerians. This country, having been occupied for over half a century by the French, has been therefore rendered sufficiently civilized to offer an asylum for European invalids. When first occupied by the French, the country was exempt

* Armand, "Méd. et Hygiène des Pays Chauds," Paris, 1853, p. 375.
Bortheraud, "Méd. et Hyg. des Arabes," Paris, 1855.

† Daumas, "La Grande Kabylie." Morell, "Algeria," 1854.

from phthisis, and, of course, the publication of this fact drew to it many consumptive invalids. The dairy cow was unknown in Algiers before the French conquest. There were innumerable herds of buffalo, indeed; but the French in vain offered a premium of fifty francs a head for the importation of dairy stock.* Up to 1854 they were unsuccessful, all these attempts proving futile. In the latest statistics from that country we find the largest proportion of deaths from phthisis among the European civilized residents.†

Dr. Scoresby Jackson makes the following remark about Algiers: "It is not necessary to prove the absence of pulmonary consumption from the natives of a country in order to demonstrate the beneficial influence of its climate upon those so affected from other countries. It would be difficult to find such a place, . . . but Algiers, at all events, approximates such a condition."

There are many other countries furnishing statistics of death-rate from phthisis where the disease is not indigenous but due to importation. I think this can be said of Greece. According to Roser‡ and Olympios, the disease is very rare in that country, and Edmond About, in his book on "Greece and the Grecians," tells us that "the town of Athens possesses only five or six cows; no other milk is drunk than that of the sheep; their butter alone is eaten. They eat meat but once a year. The entire population eats meat at Easter for the whole year,"§ and this meat is lamb.||

* Morell, "Algeria," p. 477.

† Jackson, "Medical Climatology," p. 138.

‡ Roser, "Ueber einige Krankheiten, des Orients," p. 79. Olympios, "Corresp. bayerischer Aerzte," p. 181.

§ Edmond About, "Greece and the Grecians," p. 33.

|| *Ibid.*, p. 102.

In studying the relations existing between the human and the bovine races I find that religion plays a prominent part. Thus, in India, with the Mohammedan, Brahmin, and Buddhist religions, but where, as a rule, dairy cattle have not been domesticated, there was undoubtedly an absence of phthisis before the English occupation. Hence, to-day we find all statements regarding the presence of tuberculosis uncertain. Thus Hirsch* says: "So also in India the prevalence of phthisis can not be given in figures. It is, on the whole, rarer in that part of the world than in the temperate zone of the Eastern Hemisphere, but by no means so rare as the earlier observers supposed from their imperfect means of diagnosis." Now, here is that expression of the feeling of doubt and uncertainty which we find in many works relating to this elusive disease. A man of scientific ability goes to a country and finds no phthisis among the inhabitants. After some years under circumstances that change the habits of the people, he begins to find phthisis, and therefore imagines that he was mistaken in his first observations. We find this taking place in Australia, Algiers, and Greenland. In India this vacillating expression of doubt is easily accounted for. When the English first occupied the country, the only cow they had was the small Hindoo variety, not related to our dairy cow, and this animal was and is an object of veneration, and the milk used in the country was derived from the buffalo. All the Buddhists and many of the Brahmin castes abstain from the use of meat in any form. Ansell, an early writer, says: "It appears that tuberculosis is correspond-

* Hirsch, *op. cit.*, vol. iii, p. 185.

ingly non-existent in certain localities in India." Now, there is a constant change always taking place in such a country as India. Prejudices are dying out, and many of the people have undoubtedly adopted the habits of their conquerors. The English dairy cow is slowly but surely finding her way into India, or, as Mair, a deputy coroner of Madras, says: "Beef is not at all times procurable, but is generally sold about once a week in every station where there is a sufficient number of Europeans to render the slaughter of an animal worth the butcher's while, for little beef is used among the natives. Occasionally the slaughter of a fine English stall-fed cow is advertised. In some districts the sale of beef is prohibited by law, out of respect for caste prejudices. Butter is an article difficult to procure of good quality, except on the hills, where it is sold by European settlers, who make dairy-keeping contribute to their support. The native tendency is to palm off buffalo butter for that made of cow's milk." There is little doubt that when the English dairy system becomes well established in India, the statistics of phthisis will be uniform and undoubtful. Of course, the Buddhists and Brahmins will be the last to adopt the dairy cow as a food producer.

Geographical and climatic conditions have little, then, to do with the prevalence of tuberculosis. There are undoubtedly conditions of climate, habitations, etc., that favor the development of the disease, if the contagium is present; and the contagion, I think, is always derived *primarily* from the dairy cow. The Kirghiz inhabiting the steppes of Russia, one hundred feet below the sea-level, with a rigorous clime, intensely cold winters and warm summers, badly housed and

fed during the long months of cold weather, no dairy cows, and an entire absence of phthisis. Take, as nearly as we can get, a diametrically opposite geographical and climatic condition, and we find Quito, the highest city in the world, situated ten thousand feet above the sea-level, located at the equator. "No torrid heat enervates the inhabitant of this favored spot, no icy breeze sends him shivering to the fire." "The mean annual temperature is 58 deg., the extremes 45 deg. and 70 deg. F."* Now, we have quite positive and authoritative statements regarding this city. Professor James Orton, of Vassar College, who made a scientific expedition to the equatorial Andes in 1867, under the auspices of the Smithsonian Institution, says, at Quito, "suddenly we are looking down into the valley of Chimbo; there are herds of cattle and fields of grain, yet we shall not find a quart of milk or a loaf of bread for sale. Thousands of cattle are raised on the Paramos, but almost wholly for beef. A dislike to milk (observed by Humboldt), or at least an absence to its use before the arrival of Europeans, was generally speaking, a feature common to all natives of the new continent. Some cheese, mostly unpressed curd, and a little butter, are made, but in the patriarchal style; only one American churn is in operation (in Quito, with a population of 80,000). The people insist on first boiling the milk, and then stirring it with a spoon; custom is omnipotent here, and its effect is hereditary." President Orton further says: "Consumption is unknown in the city." The testimony is unanimous that phthisis does not exist in Quito, but on the plains

* Orton, "Andes and Amazon," p. 92.

in Ecuador, according to Dr. Archibald Smith, who practiced there for twenty-five years, "the disease is not uncommon."

Professor Orton, after leaving Quito and traveling toward the Amazon, makes the following observation, which clearly indicates that the dairy cow exists in other parts of this country: "The following day we advanced five miles to Tablon, an Indian hamlet on the mountain-side. There we waited over night, and this was the only spot in South America where we found milk to our stomachs' content."

Without going into further details respecting separate communities, let us consider the statistics of Europe, and there we find that the prevalence of phthisis is regulated by the ratio of the bovine to the human race. Thus, in Ireland, where the cattle number 4,570,000, nearly an equal proportion to that of the inhabitants, according to Dr. Wylde, phthisis is by far the most fatal affection to which the inhabitants of that country are subject. Denmark, with about the same ratio of cattle to inhabitants, sustains about the same rate from consumption. In Portugal, where there are six inhabitants to one bovine animal, consumption attracts so little attention that few notices can be found relating to the disease in that country. In Italy, the distribution of cattle being one to six inhabitants, the mortality from phthisis varies greatly in different parts of the country, reaching the exceedingly low rate of 0.86 in a thousand in the Basilicata. In Egypt, where the ratio is one animal to nearly thirty inhabitants, Pruner tells us "that the disease becomes less in exact proportion as we proceed southward from the shore of the Mediter-

ranean. In Central and Upper Egypt it is decidedly uncommon.”*

Thus the statistics go on, and where the exceptions arise, the cause is always evident in the conditions that influence the breeds of cattle. Taking into consideration all the foregoing facts, there can be little doubt that the inbred species of the bovine race is the prime ætiological factor of phthisis in the human race. They not only nurse the germ and prevent its extinction, but sow it in the human race continually and abundantly; without their aid the germ would die, for of all the germs known none have so hard a struggle for existence in the human kind as the bacillus of tubercle, when we consider the comparatively few of the human race who are afflicted, and the immense number who are exposed to the infection and escape it.

The cow is the only known animal that has transmitted tuberculosis to her offspring in inheritance. I am fully aware that this statement will meet with considerable opposition, as many of our best workers are of opinion that bacillary phthisis is hereditary in the human race. But I have concluded that this is merely a theory, because, after diligent search, I have failed to find a well-authenticated case on record of a human foetus at term showing evidence of tuberculosis. We have, however, on record in the “*Fortschritte der Medizin*,” No. 7, Vol. III., 1885, a case given by Johnes of congenital tuberculosis in a foetal calf of eight months, and in Crookshank’s “*Manual of Bacteriology*” (plate 18), is a stained illustration of the bacilli from from this undoubted case. Just in the line of

* Hirsch, p. 192.

this hereditary tendency let me narrate an experiment of my own. Last summer I took the entire lungs and all the largely involved lymphatic glands from a cow dead from acute miliary tuberculosis, and, confining five laying hens and a cock, fed them exclusively on this matter till it was all consumed. I found after eight days one of the hens, which I killed, had tubercular affection of the laryngeal glands; I took twenty-six of the last eggs laid by these hens and put them under two sitting hens in another part of the farm. Twenty-three of these eggs developed foetal chicks, but not a single one lived to come out of the shell. Two or three days after the period of incubation had expired, the hens themselves broke the eggs, but every chick was dead. I took some of the eggs that I had not used for setting to the Carnegie laboratory, and Dr. Grauer searched diligently for the bacillus tuberculosis, but failed to find any. He found, however, the presence of the germ in the lymphatic glands of the hen I had killed; he now has some of the chicks, but I have received no report from him as to their condition. Of the four remaining hens and cock, some one stole the latter when he was apparently quite ill, three of the hens died extremely emaciated, notwithstanding that they had abundance of good food after they had finished the tuberculized matter, and the remaining hen was killed by the burning of the building in which she was confined. This experiment needs confirmation by further experimentation. I had no idea that the eggs would not mature, or I should have placed with them under the same hens eggs from healthy birds; there was no appreciable cause in the surroundings or other conditions to prevent

the hatching except the before-mentioned tubercular condition of the layers. I shall repeat this experiment, using eggs from healthy birds with those from tuberculous layers.

Without knowing that the fact is so, I have been looking up statistics of zoological gardens, and find that tuberculous animals fail to breed while in confinement. Of course we have no means of knowing how they behave themselves in their wild state, but I feel pretty safe in asserting that no one ever found a wild animal with tuberculosis. Darwin's statement while writing on inheritance—"that, unfortunately, it matters not, as far as inheritance is concerned, how injurious a quality or structure may be if compatible with life"—only applies to the human race and animals which the human race is instrumental in breeding. To such animals, bred by the human race, Darwin applies the term artificial. We all know that in cattle one that is injured or unable to follow the herd is killed by the herd, and bulls in their wild state only maintain their supremacy by their vigor. The moment the head of a herd suffers from age or disease he is put away by the next strongest, and thus the vigor of the herd is preserved by this law of the survival of the fittest.

Man can not generate new forms, but he can so control and interfere with nature's processes as to modify the original design. Inbred cattle are selected, sheltered, and pampered, as they would be unable to withstand the rigorous conditions of the wild state; they propagate earlier and are larger milkers and more efficient beef-producers, and their meat is more delicate and tender than that of the wild animal. All this is achieved by man at the expense of his own health.