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ORDINARY MEETING, MARCH 20, 1882.

SIR JOSEPH FAYRER, K.C.S.I., M.D., F.R.S., V.P., IN THE CHAIR.

The minutes of the last meeting were read and confirmed, and the following elections were announced :—

MEMBERS :—The Right Rev. the Bishop of Bloomfontein, South Africa ; S. R. Bosanquet, Esq., Monmouth ; Rev. Preb. J. W. Reynolds, M.A., London ; W. H. Trenwith, Esq., United States.

ASSOCIATES :—The Rt. Rev. Bishop Tuttle, S.T.D., United States ; A. E. Blair, Esq., M.D., United States ; Rev. H. Cotton, South Africa ; C. D. Fox, Esq., New Zealand ; Rev. J. N. Fradenburgh, Ph.D., United States ; Rev. T. E. Marsh, South Africa ; Montreal Library (Rev. J. Empson, Librarian), Canada ; D. Macintosh, Esq., F.G.S., Birmingham ; Rev. E. Price, Hounslow ; C. D. Price, Esq., F.G.S., Hounslow ; W. H. Peters, Esq., J.P., Devon ; Rev. Canon Tait, LL.D., F.R.S.E., Ireland ; W. Wheelhouse, Esq. (Nom. Assoc.), Huddersfield.

Also the presentation of the following works for the library :—

"Proceedings of the Royal Society."	*From the same.*
"Proceedings of the Royal Asiatic Society."	*Ditto.*
"Proceedings of the American Geographical Society."	*Ditto.*
"The Christian Philosophy Quarterly."	*From the Institute.*
"Climatic Effects in the Mauritius."	*From Dr. C. Meldrum, F.R.S.*

Also Three Smaller Works from the Rev. F. Field, Mr. W. J. Knowles, and Mr. W. H. Trenwith.

The following paper was then read by the Author :—

REMARKS ON CLIMATE IN RELATION TO ORGANIC NATURE. BY SURGEON-GENERAL C. A. GORDON, M.D., C.B. Honorary Physician to Her Majesty the Queen. In France, Officier de la Légion d'Honneur, &c., &c.

SYLLABUS.—Preliminary.—Definition of Climate.—Causes of Climate, and effect on flora and fauna.—Changes and their effects.—Forest denudation ; Italy ; Exceptions.—India.—Hindoo writers ; climate ; season.—Climate and Plant Life : zones and localities ; variation ; artificial culture.—Plants in India.—Seeds and young plants.—Tropics.—Food plants.—Fruits.—Floral calendar.—Determining causes.—Plant diseases, in relation to animals and man.—Famine.—Bacteria, &c.—Animal Life ; torpidity, hybernation.—Personal view.—Evolution.—Seasonal changes.—Diseases in animals, plants, and man.—Thunder blight.—Cattle disease.—Man—characteristics ; man and soil.—Geography of disease ; tropical ; temperate ; Scotland ; polar ; England ; public health. — India. — Acclimatisation ; plants ; animals ; man.—Conclusion.

1. EVERY extensive geographical region presents certain characters peculiar to, and distinctive of, itself. These characters include such as pertain to the physical con-

struction of the locality, its climate, its flora, its fauna, and its human inhabitants. So far I but give utterance to a most commonplace truism. Yet, if we follow for a little the train of thought which this truism naturally awakens, we shall, I trust, find that the conclusions at which we hope to arrive are not altogether unimportant, or unworthy of our consideration. To my mind our subject presents a large field for study, too large to be more than touched upon in some of its more salient points within the limits to which we now are necessarily restricted. Hence I fear my further remarks must partake, to some extent, of a fragmentary rather than continuous style.

2. The *climate* of a locality is thus defined:—"It includes all those modifications of the atmosphere by which our organs are affected, such as temperature, humidity, barometric pressure, the tranquillity of the atmosphere, its subjection to winds, its purity or admixture with gaseous emanations, its transparency,—that clearness of sky, so important through its influence, not only on radiation of heat from the soil, the development of organic tissues, and the ripening of fruits, but also on the outflow of moral sentiments on the different races."* A careful study of the climate of a locality, and of its natural history, includes all those circumstances which chiefly combine to determine the character, physically and mentally, of its inhabitants.

3. Climate is itself the result of conditions dependent upon geographical position, variations of temperature which accompany the changes of season, the succession of day and night, the incidence of the sunbeam upon a given locality, the greater or less meridian altitude of the sun, the relation of hill and plain, of continent or district to sea, the circumstances upon which periodical winds depend, the relative proportion of cloud and sunshine, hygrometric condition of the air, the state of its ozone, and so on. According to the particular combination of these conditions, so the phenomena of life, as presented by the flora and the fauna of a locality, district, or extensive tract of territory, are determined.

4. Are the conditions of climate in the same locality during successive seasons alike and regular? Far from it. They vary from season to season, from year to year, and return according to more or less clearly defined cyclical periods. Some of these changes and variations are clearly traceable to causes of a physical nature, others to more intangible influences, as electricity, and, perhaps, magnetism.† Certain

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* Humboldt. Hayden's *Dictionary of Sciences.*

† See *Handy Book of Meteorology.* A. Buchan, p. 170, et seq.

conditions are recognisable by our senses, others by delicate instruments; but there are conditions that neither barometer, thermometer, nor any other artificial means enable us to detect. We recognise some of these in their influence upon our bodily comfort, on our sensations, and so on. Others, however, make themselves known by particular forms of maladies which may affect plants or animals, or the more terrible epidemics which devastate humanity, as do tropical hurricanes forest tracts that lie in their course. Is it not the case that irregularity or derangement in the order of what by general consent is designated "seasonable weather," is accompanied or speedily followed by deranged health conditions in plant and animal life? Popular proverbs indicate that such is the fact.

5. Although, upon their grand scale, such changes in climatic conditions as have occurred in the progress of time have been brought about altogether independently of human agency, instances are numerous in which by the intervention of man and by other physical agency such alterations have been effected. A very few instances must suffice. In the Cape de Verd Islands, destruction of the forests by burning had the effect of drying up the springs and rendering the climate sultry. Persia, Greece, and other countries have from a similar cause had their climate deteriorated. In the Pyrenees the cutting down of the forests had rendered tracts * unhealthy by the destruction of the barrier which formerly had excluded the southern winds. In Castile and Arragon similar complaints were made long ago. In America cutting down the forest has rendered localities drier and more healthy, as "the wood fever" has disappeared.† And there are many other examples of climate being affected by means of forest denudation. While these notes are being arranged, a striking illustration of the subject now in hand occurs in Italy. In certain districts, during the last ten years, terrible inundations have destroyed much life and property, and have moreover caused considerable sickness where formerly the localities were healthy. Public inquiry has established the point that these unfortunate changes were due to what is described as "the mania which has impelled proprietors to cut down forests." ‡ Mountains which for centuries had been covered with pine and oak-trees were reduced to bare rocks; picturesque valleys were converted into swampy marshes. As a result of measures taken to restore the original state of

* The Valley of Azun. † Hopkins' *Atmospheric Changes*, p. 83.
‡ *Morning Post*, Nov. 3, 1881.

things by replanting denuded tracts, barren hills have again become healthy and picturesque. Moreover, vineyards, the produce of which has been deteriorated, and themselves liable to inundations while the forests were destroyed, are once again free from such risk, and the quality of their wine is of its old standard.* And yet the rule must not be looked upon in all cases as absolute. At Murree and Simla coniferæ abound, in the former place as extensive forests. As painful experience has for some years back demonstrated, cholera is localised in both. At Ootacamund, forests of eucalyptus globulus exist; several other species of that genus have also been planted in that locality. Malarial fevers, however, originate there in persons long resident in the place, and since 1877 cholera has obtained a footing in that once beautiful station. It is evident, therefore, that neither coniferæ nor this much-lauded member of the Myrtaceæ necessarily and absolutely abolish endemic disease affecting persons foreign to particular localities.

6. By similar means the climatic conditions of Upper India have undergone change and deterioration within historical times, although the date is somewhat ancient according to accepted chronology. During the wars preceding the subjugation by the Arian invaders of what now constitutes a considerable portion of the Punjab, dense forests covered the surface of the country. As at the present day, in the far west of America, clearings in the forest took place, and, ultimately, tribes thus became permanent settlers. Visits of ceremony and friendship were interchanged by rulers, rajahs, and maharajahs. Among the duties of hospitality was to clear away the intervening jungle, open up a road, make straight the way by which the distinguished visitor was to travel attended by his retinue. And a similar custom still exists.

7. According to the great Hindoo epic poem, the Mahabarata, prosperous cities, richly cultivated lands became established; the inhabitants had abundant food; they were long-lived; as far as can be gathered, epidemics among them were of very rare occurrence; illness was looked upon as punishment by the gods for some sin committed;† the natural

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* At the Polambella.

† A similar theory of disease existed in ancient Egypt. A tablet of the time of Rameses XII. (12th century B.C.), to be seen in the Paris Library, and translated in *Records of the Past*, where the Egyptian god, Khons, was sent to cure the little princess Bentaresh of the evil movement in her limbs. When he came, the demon said, "Great god, who chasest demons, I am thy slave, I will go to the place whence I came."—*Anthropology*, by E. B. Taylor, p. 354. Throughout India, China, Syria, and in other countries a similar theory of disease held good. In times more recent,

duration of life among them was said to be one hundred years; and their domestic condition may be judged of from the characteristic recorded, that men loved *their own* wives. But now, and for long cycles of years back, much of the forest thus alluded to has ceased to exist; long wastes of semi-desert country have taken its place; the surface yields only stunted acacias, capers, and asclepias; rivers which then existed are decreased in size; one historic stream, the sacred Suruswattee,* has for centuries ceased to flow, and cities situated in the less arid localities, are periodically swept by epidemics, terrible by their fatality.

8. From times the most ancient, the relation of climate to organic nature was recognised by Hindoo writers.† A very few examples must here suffice. A swampy country was indicated as *Anupa*. In such a tract "lilies and other water-flowers abound; the air is cool; geese, ducks, cranes, fish, and serpents abound. In such a situation the inhabitants are unhealthy and short-lived." The hilly country, or *jungala*, was characterised by "arid plains, on which dwarf trees and prickly shrubs grew sparsely; the heat of the air is great, and hot winds prevail. In such a country there is little water upon the surface, and wells have to be dug." Diseases of air and bile—that is, intestinal and hepatic—prevail, but the climate is healthy, and the inhabitants long-lived. It is further added, that when the above-enumerated conditions are found in the same country the general climate of that country is described as mixed.

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the *demon* of disease in Western nations is believed to manifest himself under the name of "specific germs." The subject of so-called "specific germs" in relation to zymotic diseases obtains a great deal of attention. With regard to it the following are some of the conclusions arrived at by speakers at the meeting of the International Medical Congress, and by writers subsequent to that occasion. Although "germs" have been found in the products of inflammation, they have not always been so. The "specificity" of germs is still an unsettled question. The theory in regard to their presence and character is no more than an assumption. Each theory is contradicted by another. Were the presence of "germs" definitely determined, which it is not, the question would still remain, whence do they obtain their specific properties? Also, how do they start into activity; how cease to be in activity, and what becomes of them while "dormant"?

* Suruswattee passes by the holy town of Thaneshur. In ancient times it seems to have flowed across the Rajputana plains to join the Indus below its confluence with the Punjab rivers. Its deserted bed can still be traced as far as Mirgarh, in Bhawalpore; but the water now only penetrates to Bhatneir in Rajputana. In "the upper part of its course it dries up partly in the early part of the year, becoming then a series of pools (whence its name). Many of the early Arian settlements were on the banks of this river."—From Hunter's *Imperial Gazetteer*.

† Chakrata.

9. Similarly, the relation of the seasons to health was carefully noticed. The year was divided into six seasons, namely, the cold, the spring, the hot, the rainy, the moist, and again the cold; so that the first-named included our months of January and February, the last-named our November and December. As to instructions with regard to what would now be designated personal hygiene in each of these seasons, I select one, namely, the hot, including our months of May and June. Chakrata said: "Use cool foods, and food prepared with ghee (clarified butter); drink sherbets; use broths of wild animals and birds; eat rice with milk and ghee; little wine is to be used, and always mixed with much water; do not take much exercise; sleep during the day in a cool room; at night in the upper rooms; use the hand-punkah sprinkled with sandal-wood and water." The date when these instructions were first issued is variously given as the sixth to ninth century before the Christian era. And yet there are those who say, and perhaps believe, that not until the nineteenth century of our era—that is, twenty-five centuries after the time of Chakrata—was hygiene, as a practical thing, evolved from man's "inner consciousness." But time prevents the further consideration of this portion of our subject.

10. Of all the influences to which plants are exposed, climate is the most important; it sets absolute limits to species.* Plants have been referred† to divisions in classification according to their relation to climatic conditions—namely, 1, Macrotherms, those of inter-tropical regions; 2, Mesotherms, those of sub-tropical and warm, temperate zones; 3, Meiotherms, or those inhabiting cool, temperate zones; 4, Microtherms, or those inhabiting alpine or arctic regions. With reference to the local characters of climates, another method of classification has been adopted, as Xerophiles, or such as pertain to very dry climates; Hygrophiles, or those which abound in abundance of moisture; and Noterophiles, or those intermediate in character. Structural conditions of plants also correspond to the character of climate and soil in which they exist—monocotyledones in hot climates, dicotolydones in cold. Those deep-rooted for extremes of heat and cold; those with shallow roots for equable climates.‡ The character of foliage, alike in type and in continuance, differs in unison with differences in climate.

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* Changes of climate must also have their influence upon the migration of plants. A region, when its climate was different, may have been a high road for migration for plants, although it is now impassable.

† By Decandolh.

‡ Henfrey's *Elementary Course of Botany*, pp. 660, 661.

11. Variation in the character of plants according to locality, even within the zone in which they are indigenous, is a phenomenon familiar to all. When those of one zone are transferred to one more torrid, or one more frigid, whether by reason of latitude or elevation, changes in character, as in appearance, become still more defined.* Even in Britain the same species presents very different characters, according to its position in these respects. Trees, shrubs, and other plants, introduced from climates more or less closely approximating to that of these islands, in many instances refuse to propagate their kind. In some of these inflorescence does not take place, in others the flower drops to earth or withers, but without producing fruit; in others there is, for a time, a promise of fruit, but soon the seed vessels die away, and gardeners, when they desire to propagate the species, are only able to do so by "slips." In other instances the properties of plants become altered; in others the species flourishes for a time, then gradually fades, and becomes extinct. In man analogous phenomena to some extent occur. And yet there are phenomena in relation to the distribution of plants which are unaccounted for by conditions of climate alone. Thus, localities the "climate" and rainfall of which are nearly as possible alike, have not necessarily identical floras, any more than identical faunas. Certain plants also have only a local distribution. For example, *Erica vagans*, or Cornish heath, on soil of broken down serpentine; *Cypripidium*, or lady's slipper, on alpine limestone in the Swiss Alps. The *Oxytropis campestris* is confined to one spot on the Clova hills. *Cotoneaster vulgaris* is, in Britain, found only on the limestone cliffs at Great Orme's Head, in Wales. *Potentilla rupestris*, in Britain, only on the Breddin Hills, in Montgomeryshire. A flowering plant may be found in the arctic and temperate regions, and then reappear in the southern temperate and antarctic regions, but none range from pole to pole. Every species which at once exists on two continents is also found on the intermediate islands.

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* The American water-weed (*Anacharis*), first introduced into this country in 1847, has spread with great rapidity, expelling the native species with which it came in contact, though it has never yet produced seed. In America it is not more troublesome than other weeds. In the Neilgherry Hills the *Lantana* threatens to choke the coffee on some plantations. In New Zealand the *Rumex acetocella* and the cat's ear (*Hypocharis radicata*) are destroying native pastures. The spread of *Vallisneria* in the Hudson is as extensive as that of *Anacharis* in Britain.—Daubeney on *Climate*, p. 73.

12. Even when protected by artificial means, as in greenhouses and conservatories, the characters of plants in this, or to them other alien climate, differs much from those in places where the same species are indigenous. This circumstance is, no doubt, familiar to all of us who have noted conditions as seen in tropical regions, and in the houses in which the same plants are maintained for use, ornament, or luxury, in and near London, as elsewhere. With every care that can be bestowed upon the management of such places, extending to heat, moisture, degree, and kind of light, and so on, the fact remains that these plants are in an alien *climate*, and their condition suffers accordingly. Attempts are made, more or less successfully, to lead to the inflorescence of particular plants in seasons other than those in which that phenomenon naturally occurs. One familiar to most of us is the common lilac (*Syringa vulgaris*), forced into blossom at Christmas-time; the result, pale, sickly, etiolated flowers and leaf. And so it is in other instances.

13. Residents in India, whether in the plains or hills, are well aware how great and rapid are the changes which occur in the character and life of plants imported from England. In former years the sight might be witnessed of a daisy, the common crimson-tipped flower so named (the *Bellis perennis*), being despatched, like human invalids, to the hills, so as to avoid the coming heat of summer; the same plant brought down and restored to its accustomed shelf, as the cold season again set in. English shrubs become so altered in appearance as to be unrecognisable; our favourite flowers change their time of expanding, and gradually lose their well-known fragrance. In like manner, English vegetables deteriorate, and that so rapidly, as, after the second crop, to be of no farther value. In the hilly districts, exotic trees become attacked in great number by some of the many species of *Loranthus* there met with. In this way the parasite is multiplied; it attacks and destroys the native forest trees in yearly increasing numbers.

14. Seeds introduced from cold and temperate climates into those more torrid are found in a large proportion of instances to have lost their power of germination. Notwithstanding the great care dictated by experience as necessary in the attempt to rear such plants as have germinated, the circumstance is within the personal knowledge of all who have observed phenomena that the young shoots, pale, etiolised, and delicate from the hour they show their tiny leaves above ground, at first thin and lanky—soon bend, droop, then die and decay, leaving the few of what in the phraseology of the

day may be indicated as survivals of the fittest to come up, grow, lose the characters of the originals, or assume others strange to them. And so, the question comes to be, For what purpose are they the fittest? Certainly not for that served by them in their own natural conditions. Neither for that served by those indigenous. But the expression, so long as it is used in an abstract sense, serves its purpose.

15. The processes alike of development, growth, and decay of plants proceed with the greatest degree of rapidity the nearer their locality approaches the equator. Everywhere in those regions forest vegetation is rank and luxuriant; everywhere do decay and decomposition taint the hot, damp atmosphere, the lower organisms of plant life preying upon and accelerating the destruction of the higher. There being little, if any, difference of season or of atmospheric conditions, there is not, as in temperate regions, cessation at regular periods or at any period to these processes. Life and death proceed side by side, creatures of the animal world suited to the locality and conditions inhabit the rivers, swamps, and forests. Human inhabitants there are too in many such localities, though not in all; but in them *intellectual* man exists not indigenous.

16. Food plants differ in their genera, and in several other particulars, according to geographical position, including climate. In tropical regions rice, for the most part, flourishes in low-lying, swampy tracts, although what is named hill-rice is an exception; maize, or Indian corn, upon less swampy, but alluvial soil; millets of several kinds, and *eleusine* (in Madras called by natives, ragi), on the dryer kinds of soil. For temperate climates, as in that of England, the relation of particular kinds of cereal and other crops to local conditions, alike of soil and climate, determines to a great extent the success or failure of the agriculturist.

So it is also in regard to fruits. These, even when of the same species, differ in respect to size, shape, colouring, flavour, and in other respects, according to climatic conditions. This applies equally to tropical and to temperate climates. Nor are medicinal plants exceptional in these respects. Their active properties differ according to local climate and soil. And similarly with beverage-yielding plants—the tea shrub, coffee shrub, and so on—their produce varies in quality and flavour infinitely.

17. The entire succession of phenomena which occur in plant life is connected with, and dependent upon, season; but this relation is not alike as regards all genera. By the order in which the several stages of vegetable existence

occur, it were easy to illustrate a floral calendar, for this or any other country. How comes this difference about? Atmospheric conditions suitable for the regular succession of phenomena in one series of plants are not suitable for the same order of phenomena in other series. The fact is familiar to the most ordinary observer. But the ultimate cause of the fact is only to be indicated by a word—adaptation, a quality inherent in the individual. Here, in England, with questions connected with agricultural industries prominently before the public, as of late years they have been, and still are, the dependence of these industries upon conditions of the nature already indicated is a fact prominently brought to the knowledge of persons and classes concerned.

18. Neither are we able to indicate, in a manner more precise and definite, the actual nature of the determining influences to which are due the variation experience demonstrates as existing in such phenomena of plant life, as differences in growth, luxuriance, fructification, &c. In no two successive years are these alike. The quality of fruit grown upon the same ground, and as nearly as possible under precisely similar conditions, varies from year to year; nor can the most observant nurseryman supply a plausible explanation of the circumstance. In India, where from ages the most remote the natives have carefully and accurately noted the relation that manifestations of nature bear to each other, the circumstance is acknowledged that unusual developments and profuseness of inflorescence often precede the recurrence of epidemic disease in man. In this country, not only have particular kinds of plant disease made their appearance within recent years, but their recurrence takes place in relation to season. The disease in our most common esculent, the potato, caused immediately by the fungus, *peronspora infestans*, occurs and recurs, as a rule, in July and August; the *beet* disease, due also to a fungus, occurs sometimes in the winter season. With the failure, from seasonal causes, of particular plants, more especially those that yield food supplies, disease among animals and man follows so regularly that pestilence and famine are considered as bearing to each other a relation similar to that of effect to its cause. The intimate connexion which exists between the conditions of meteorology in a given district and productiveness of food-yielding plants has obtained many and very terrible illustrations in our great dependency, India. Never, since 1770, has so great a famine befallen that country as that which, in 1876-7, extended over the Madras Presidency and a considerable portion of the Deccan. The vast importance attached to this consideration appears from the circumstance,

officially recorded,* that notwithstanding the immense exertions by the local government, and by individuals, to grapple with that famine by the importation of food, distribution of money, and other means, the actual loss of human life during the two years it continued, including the excess of mortality over ordinary years and diminished birth-rate, did not fall much short of three millions of lives. Besides this, the physique of survivors was lowered to so great an extent that they were less capable than before that event to prosecute their regular avocations.

19. Certain forms of organic matter, under the names of Bacteria, Vibriones, Zooglea, and so on, have of late obtained a large amount of scientific attention. It is an open question still, whether the nature of these forms is vegetable or animal, or intermediate between them. Their development, however, appears to be enhanced by atmospheric conditions which favour decomposition of tissues. And this circumstance furnishes the only point in regard to which reference to them is here appropriate. The result of recent discussions as to the part played by these organisms in the direct causation of disease is that, like several other favourite theories, so, in regard to this one, strict investigation is unfavourable to its stability.

20. With regard to animal life, much of what has been said in reference to the relation existing between climate and plant life applies. Thus, families, orders, genera, have their geographical limits; relatively small numbers are restricted to particular territories and localities; characters and habits have a distinct relation to climatic and seasonal conditions. But, unlike plants, many animals capable of and performing migrations thus avoid alternations and changes, as regards atmospheric conditions, to which others, like plants, are subjected. Of the particular sense by which these are guided, alike as to the period and direction of their migrations, we are not able to speak, further than that in our own persons there occurs nothing analogous to it, unless, indeed, it be the capacity, not very common, of knowing directions. As with plants, so changes occur in the character and appearance of man and animals in accordance with localities and circumstances in which they are placed. Finally, health, and the loss of it, have relation to circumstances connected with climate and season, besides others more personal to individuals. As with plants also, the rates of increase and diminution differ according to local circumstances.

* Report by Sanitary Commissioner, 1878, p. 21.

21. Analogous to the seasonal rest of plants in temperate zones, and in those more severe, is the torpidity and hybernation of certain animals, warm as well as cold-blooded. Similar and equally well-marked analogy presents itself in other seasonal phenomena exhibited by them. As the process of metamorphosis* in the development of the young plant is accelerated or retarded by certain conditions of climate and season, so is the corresponding process, properly so called, in relation to particular forms of animal life effected by similar states.

22. Here I would beg to express a personal view. It is, that inasmuch as the process of metamorphosis is a condition of *life* leading towards ultimate perfection of organs and performance of their functions, so are the processes which constitute disease, retrocession of life towards physical death, preparatory to reconstruction of elements by which successive generations of organised beings rise up, each in turn to disappear, and be no more seen in its former identity. All such processes, alike of advance and retrogression, are inherent in living things. Whence their ultimate cause pure science tells us not, but philosophy, when unfettered by the finite, points to that great Power beyond.

23. Is the remark made, These phenomena are so many of a series all due to "Evolution"? I quote from two recent writers in reference to the principle to which that expression is applied after this manner: "What is 'evolution' but another expression for the effect of natural causation? By strictly defining the limits and potencies of what we call Nature, evolution forces upon us the existence of the supernatural."† "Throughout nature there is a continual passing from movement to repose, which is not rest—a ceaseless oscillation from life to death, from death to life. The order of physical phenomena, like the order of mental phenomena, is inscrutable, flowing from a past eternity to a future eternity."‡ What, with reference to this subject, concerns our present purpose, is the circumstance that the phenomena indicated have more or less defined relation to season, as well as to periods. Here we touch alike the borders of pure science, and of the abstract, because intangible—the unthinkable.§

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* *Structural and Physiological Botany.* Thomé, p. 220.

† *Nineteenth Century,* September, 1881, pp. 383 and 390.

‡ *The Supernatural in Nature.* J. W. Reynolds, p. 94.

§ What other power than that here indicated as "natural causation" produces the phenomena to one set of which the expression "evolution" is applied, to another "natural selection"? The reply to this query has yet to be given, at least in the phraseology of the scientist. To the philosopher the

24. Several of the phenomena of animal life present a distinct relation to meteorological conditions, and seasonal changes. This relation is, for the most part, more apparent as regards what are called the lower forms of life, than what are designated the higher. What, for example, are the ultimate causes which determine the abnormal profusion of insect, or even yet lower forms of life, in particular years and seasons, as compared with similar periods separated by intervals more or less long? Except that the recurrence of such phenomena takes place during the same periods of the year, little, if anything, further transpires on the subject. Ova are deposited in myriads every year; but only at intervals, sometimes of several years, is full development attained.* Equally remarkable is the destruction which, at intervals, sweeps over and destroys entire races of animals. With regard to some forms in which that destruction happens, no relation to season or special locality has been determined. With regard to others, the occurrence of widespread mortality has a distinct connexion with seasonal and climatic diseases among plants and in the human species. In Sweden, for example, the occurrence of pests among flocks and herds at the commencement of the national celebration of the midnight sun—namely, about the first of May, is looked upon as a seasonal "visitation," only to be averted by *sorceries*. In India, the seasonal recurrence of what are called malarial diseases in man, is signalised by the prevalence of similar affections, not only among imported animals, but among those indigenous. In that country the phenomena of animal life,

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mere substitution of a word by another word matters little. We require not to revert to geological periods to observe in organic beings changes and modifications according to local conditions and circumstances in which those beings occur. To obtain practical confirmation of this fact, no scientific process of inquiry is necessary. Let us, for example, proceed to India by one of the ocean bridges which span the distance between England and her greatest dependency. Let us note, while *en route*, the conditions of physical geography, of meteorology, the characters presented by animated life, whether vegetable, animal, or human, and, at the end of our voyage, let us write to our friends at home and tell them whether or not, in the course of our passage we have observed as great differences in general, as numerous and striking modifications in type, as many instances confirmatory, if we so desire them to be, of "evolution" as are to be traced by comparing the remains found in a particular geological stratum in one region with those of similar or even different state in another region. Still more so is this the case if we continue our journey eastward to Australia and New Zealand. Again more so, if we return homewards, *viâ* America and the Antilles.

* Here is an example. In October, 1881, locust eggs were collected at Nicosia alone at the rate of 20,000 okes, or 55,000 lb. per week. An oke contains on an average 13,500 eggs, so that the total gives 270,000,000 locusts destroyed.

in relation to the occurrence of diseases which have a direct dependence upon season, as also those which at intervals are epidemic, have of late years attracted a little of that attention which the subject merits, and will, doubtless, hereafter receive. When, in our investigations, we, to a greater extent than has hither been done, look upon organic nature as constituting one great unity, the phenomena of one division as having a relation to those of other divisions of that unity, and all alike influenced by surrounding conditions, then may we expect that greater results than have heretofore followed our inquiries shall be attained.

25. Here, in our own country, the relation of aphidæ and other insect pests to season, and to particular seasons, is sufficiently and unpleasantly familiar. No reference to thermometer, or barometer, is needed to indicate what our own senses tell us is weather in which blights appear in gardens and orchards. The circumstance has recently been recorded that the appearance of the *Thrips cereale* takes place in connexion, as regards time, with the recurrence of electric disturbances of the atmosphere; hence the popular name "thunder blight" given to that creature.* Among other circumstances for which no precise and definite cause has been discovered, are the process by, and manner in, which species and genera of such "pests" as are alluded to succeed each other. Having appeared, their recurrence has reference to season. But how about their first development in myriads? There is no reply.

26. The relation of diseases in animals to season obtains confirmation by what, unfortunately for those concerned, and for their owners, has in this country come to be nearly the usual state of things. Here is a recent illustration. In Norfolk the disease among cattle, known as splenic apoplexy, first made its appearance on July 12, 1874; on the second occasion of its prevalence, the date of its first attack was June 19, 1877; that of its third appearance June 10, 1880. To what special conditions this comparative uniformity in the recurrence of anthrax refers, we have no sufficient data to show. Possibly—so runs the article† quoted from—"in this direction meteorological science, aided by topographical considerations, may sooner or later afford us a clue to the solution of the question." It is added: "As in 1874 and 1877, so in 1880, the primary source of infection cannot be urged alone as the centre from which the more general outbreak sprung."

* Hardwick's *Science Gossip*, October, 1881, p. 224.

† *Journal of the Royal Agricultural Society of England*, Vol. VII., 1881. Part I., p. 50.

27. No more than a passing allusion can be made to a few of the more striking points that bear upon the natural history of man. Examples occur in the physical characters of races, and the geographical limits within which the majority at least are confined; the tint of iris; colour and texture of skin and hair; relative proportions of parts of the body; relative height and chest measurement, and so on. As with physical, so with mental and intellectual characteristics the differences which exist among peoples and races are absolute; their occupations, their poetry, their habits, their character—each and all owe their distinctiveness to, as they are adapted to, the circumstances of locality and climate. "That certain races are constitutionally fit, and others unfit, for certain climates, is a fact which the English have but too good reason to know, when on the scorching plains of India they themselves become languid and sickly, while their children have soon to be removed to some cooler climate, that they may not pine and die."* Here I guard myself against the assumption that climatic conditions are by themselves the determining causes of race and all the peculiarities by which it is distinguished. The general question is beyond our present scope. All I desire to express is that the characters alluded to coincide for the most part with defined conditions of climate and place.

28. As expressed by a recent writer,† "Man, like the productions of the earth, is in relation to the soil upon which he lives. From times the most remote it has been observed, with regard to inhabitants of hot countries, that their habits are those of indolence and apathy, combined with liability to sudden and temporary 'exaltation' of the nervous system, an absence of energy and self-reliance, which render them docile in bondage, and disposed, more than the natives of colder countries, to bear the inequalities and privileges of birth and chance. Let the natives of such countries be removed to colder regions; there they become incapable of entering into competition with the inhabitants of such regions, even as regards unskilled occupations. And not only this, but, when transported to reside in other parts of the tropics than those to which they belong, they suffer to a greater extent from disease in their new locality than do natives of colder climates who leave their country to reside in the same locality." Thus it seems to be that, as under tropical influences development, growth, and decay in plants and lower orders of the animal kingdom are fostered, without corre-

* *Anthropology.* E. B. Tylor, D.C.L.; LL.D.; F.R.S.; p. 73.
† Ch. J. Masse. *Apropos du Railway Trans-Saharien,* 1881, p. 17.

sponding "tonicity" in their organisation, so with man; the denizen of equatorial regions is by a law of nature restricted to his geographical limits.* Are we, then, to view the prospect as a law of nature that tropical regions are destined to be for ever peopled by a human race whose physical and mental characteristics are still to be such as have been described? That in those regions, amidst dense forest, dank, luxuriant, but unwholesome vegetation, amidst swamps, marshes, and lagoons, tenanted by fierce animals, hideous and fierce creeping things, tropical man must continue as he has heretofore been. According to my own view, the laws of climate determine that such must happen.

29. The geographical distribution of disease realms is no less defined than that of other phenomena in Nature. Meteorological conditions are among the most important of the factors to be taken into account in determining growth, development, and health of man, as of other organised beings. But other concurrent circumstances also exert their influence, favourably or unfavourably as the case may be. Among them latitude, local situation, nature and elevation of the soil, the presence or otherwise of rivers, lakes, swamps, forest or other vegetation, desert tracts, and so on—in fact, *physical climate* generally, together with habits of a people, their food in relation to produce of the land, their habits, and so on—all concur to stamp diseases among communities with a special character.†

30. The tropical zone is bounded north and south by the mean annual isothermal line of 80 deg. F. The diseases which prevail in greatest constancy and frequency within

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* The following particulars are from the *Army Medical Blue Book* for 1879. They refer to sickness, mortality, and invaliding among white and black troops respectively in the West Indies, viz. :—The ratios are per 1,000.

Admitted, white troops	641·1	black troops	1152·8
Died " "	10·27	" "	17·57
Invalided " "	27·10	" "	27·23
Constantly sick "	32·63	" "	54·90

The following are the averages for ten years prior to 1879 :—

Admitted, white troops	911·0	black troops	1047·03
Died " "	11·47	" "	19·42
Invalided " "	19·32	" " *say*[1]	27·23
Constantly sick "	41·93	" "	54·90

† In the tables quoted the ratio invalided is not given; that here entered is in accordance with what took place in 1879. The same reports show that

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[1] These and some of the succeeding remarks are based upon the chapter, "Medical Geography," in Dr. Aitken's *Science and Practice of Medicine.*

this realm are well known to Army and Navy medical officers as those which are most inimical to our soldiers and our sailors on foreign service. Here, season exercises a very definite influence upon their rate of prevalence and upon their severity. But throughout the whole of this zone the phenomena of diseases present variations, as do those of physical and organic nature. Certain forms of disease have within it their special limits. One form, namely, cholera, appears in this respect exceptional. Only within very recent years has it ever passed the limits within which for centuries it had been, as it were, confined; within our own day has it assumed the character of a raging pestilence, sweeping over all latitudes, its track everywhere marked by households rendered desolate.

31. The temperate zone extends from the preceding north and southward to the annual isothermal line of 50 deg. F. In the southern hemisphere, the most healthy regions in the world are comprised within this zone. In the northern, while the greatest degree of variety exists in regard to the processes and types of diseases, they are, as a rule, more manageable, less intense, and less fatal than corresponding attacks in the tropics. As, on the one hand, the arctic, on the other the tropical region is approached, so extremes and intensity of climatic conditions vary, so differences recur in the types and forms of organic nature, and so the phenomena of disease change, partaking more and more of distinctive characters, which pertain to the boundary regions. The British Isles lie within this zone. In them, as elsewhere, the death-rate of the human population is in a ratio corresponding with the extremes of temperature, between the summer maximum in July and winter minimum in January.* Inasmuch, therefore, as that range is less in Scotland, the colder, than in England, the milder country, so is the death-rate smaller in the former than in the latter. With the colder climate also came those physical characteristics by which "the children of the mist," the brave mountaineer of "Caledonia, stern and wild," was distinguished. Shall I say,

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a difference exists as regards the diseases by which British and African troops in the West Indies respectively die. Thus, there died in

1879	by	Fevers	3	whites	.....	no blacks.
„	„	Tubercle.....	1	„	.....	4 „
„	„	Circulation.....	no	„	.....	6 „
„	„	Nervous.....	2	„	.....	no „
„	„	Respiratory	1	„	.....	2 „
„	„	Digestive	2	„	.....	4 „

These besides injuries. Strength for the year, 1,070 white, 1,138 black.

* *Handy-Book of Meteorology.* A. Buchan, p. 176.

and still is? Certainly! That he is so is as much the result of climatic and other natural causes as is the hardy fir-tree, the *Pinus sylvestris*, the forests, and isolated individuals of which give to highland glens and hill faces their peculiar character.*

32. All beyond the isothermal line of 41 F. includes the polar zone of disease. There, malarial diseases such as endanger and often embitter life in the tropics are absent. Climate is absolutely different from, and as nearly as may be, the opposite in character of that near the equator. With each returning spring, and regularly as plant life becomes revivified, disease in the form of influenza, asthmatic or catarrhal affections occurs among the human inhabitants. These impair the health even when life is not destroyed, and so the majority of the people are short-lived. As with particular forms of plant and animal life, so, with regard to forms of disease which affect humanity, the zones in which they are indigenous are limited in extent. But this cannot now be further adverted to.

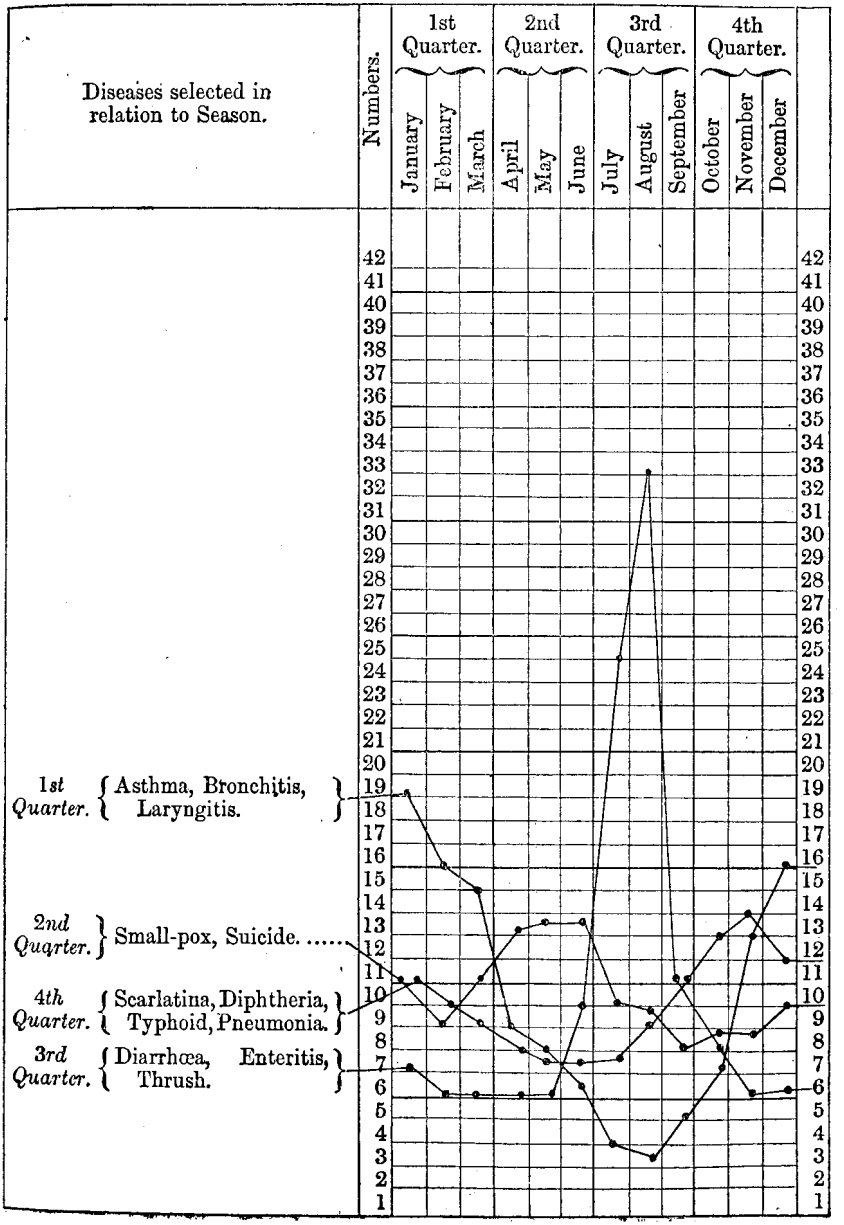
33. In our own country the relation of climatic conditions to the state of public health is a subject to which the attention of observers is at the present time much directed. It is a matter within the cognisance of all that particular forms of illness rise and fall in numbers according to season and to meteorological conditions. This subject was lately discussed before audiences in this metropolis; † on the occasions when it was so, the remarks made by the eminent men who brought it forward were illustrated by diagrams, and by these diagrams the relation was made apparent which exists between particular forms of disease and particular seasons of the year. In fact, inasmuch as in the vegetable world phenomena of life manifest themselves in their several stages according to season, and differently in different orders and genera, so in man do vital phenomena vary under seasonal influences and climatic conditions; retrocession or decay being brought about in varying manners of the process, to each of which a name is given

* Equally distinct and characteristic are other individuals of the organic kingdoms; among animals the red deer, the roe, the mountain hare, the grouse, the ptarmigan, and so on. Among plants the mountain ash,[1] the dwarf birch,[2] the *empetrum* or crowberry, the cloudberry or "averan" (*rubus chamæmorus*), the cranberry (*vaccinium oxycoccus*), the bleaberry (*vaccinium uliginosum*), and so on.

† Lecture by G. R. Langstaff. See *Transactions of the Epidemiological Society of London*, Vol. IV., Part III., 1878-80; also *Lecture on Weather and Health of London*, delivered at the Royal Institution. See *Nature*, June 23, 1881, p. 173.

[1] *Pyrus aucuparia.* [2] *Betula nana.*

CHART *representing the prevalence in England of particular Diseases in relation to Seasons. Mean for the year taken as* 10.



signifying a particular form of disease. Inherent qualities in the individual and mass lead to these changes as regularly and surely as do others inherent in the plant itself, first to autumn tints, then shedding of the leaf, and to the varying manner in which according to their kind fruits ripen, decay, and finally drop to earth. Certain forms of disease have what may be termed double crops during the year; but the general rule is as stated. In illustration of these remarks I instance laryngitis, bronchitis, and asthma, as diseases of the first or coldest quarter; small-pox and suicide as the disease peculiar to the second quarter, for no doubt self-destruction is a disease.* Nervous affections, intestinal disorders, and, among children, thrush in the third or hottest quarter; scarlatina, pneumonia, diphtheria, and what in recent years has been designated typhoid fever, in the fourth quarter.

TABULAR VIEW OF DISEASES ACCORDING TO SEASON IN ENGLAND.

Standard taken as 10.

Months.	1st Quarter. Diseases.			2nd Quarter. Diseases.		3rd Quarter. Diseases.			4th Quarter. Diseases.			
	Asthma.	Bronchitis.	Laryngitis.	Small-pox.	Suicide.	Diarrhœa.	Enteritis.	Thrush.	Scarlatina.	Diphtheria.	Typhoid Fever.	Pneumonia.
January	23	21	12	13	9	3	10·5	8	11	10	9 8	14
February.....	18	18	13	12·5	6	3	7	8	7	11	11	11·5
March	16	16	14	11	11	2·5	10·5	6	6	9	9·8	14
April	7	11	9	13·5	13	3	9·8	6	6·5	9	9	10
May.....	5	9	10	14	13	4	6	8	6·5	8	8	8 5
June	6	7	6	12·5	14·5	10	10	10	8	9·5	7	6
July.....	4	6	4	8	11	40	16	19	9	9	9	5
August.....	4	2	4	8	11	34	13	19·5	10·5	10	12	5
September ...	4	6	5	8	8	13·3	12	8	14	10·5	12	8
October	7	9	7	8	9·5	7	10	9	16	11	14	10
November ...	15	16	9	9	8·5	4	7	8	15	13	13	16
December ...	18	18	12	11	9·5	3	9	8	10·5	11	10·8	16

* When we find that the hot, bright months of summer are those in which suicidal tendency prevails most, we seem to recognise physical, rather than psychical, influences. Suicide, also, is more common in the daytime than at night; it is particularly so at 8 a.m., at noon, and at 3 p.m. Strangely, also, it is more prevalent on Monday, Tuesday, Wednesday, and Thursday, as compared with Friday, Saturday, and Sunday (except among women, with whom this *disease* is most prevalent on Sunday). See the observations by Guerry in France, quoted by Dr. Henry Morselli, in his book on *Suicide*, p. 76. (Published by Kegan Paul & Co., 1881.)

34. In India the relation existing between irregularity of seasonal conditions and health and disease is well understood. It is a recognised fact in the Punjab, that an unusually wet autumn will be attended, as a rule, by a heavy fever-rate; while a dry season will be a healthy one; that, on the other hand, heavy winter and spring rains have little, if any, influence on the degree of fever sickness. At Peshawur, the British troops suffer greatly, owing to the prevalence of heat fevers during the hot months, namely, May, June, and July; from those of a so-called "malarious" nature from the month of September to that of December—that is, during the prevalence of the rains. As illustrating the association of unusual dryness with the occurrence of more than usual sickness, two instances must suffice, both having reference to Jhelum. At that station the years 1872 and 1876 were peculiarly unhealthy. In the former year, the autumnal fall of rain was below the average; in the latter, while the rainfall was 22·3 inches as compared to 1875, fever occurred among the troops in the ratio per 1,000 of 960 cases, as against 505 in 1875. Cholera also prevailed. As recently as the month of October last, accounts continued to reach us by each weekly mail that during the autumn unusually heavy rainfall occurred at Umritsur, the quantity amounting to 40 inches, instead of 18, as an average of ordinary years. Pestilence, in the form of choleraic fever, broke out as a result and consequence. In that city 242 deaths were reported as having occurred on September 28th, and on the day following 280, and so on for several days.

35. The subject of acclimatisation with reference to plants, animals, and man, can be no more than touched upon. Its importance, however, is manifest. The term itself implies adaptation to conditions of foreign climates at first injurious, and the capacity of surviving and flourishing in such conditions. It has a significance different from that of domestication; also from that of naturalisation. Thus a large number of European plants have been introduced, and flourish in America and in New Zealand, without having undergone the process of acclimatisation properly so called. In Britain the canary bird is domesticated, but not acclimatised; that is, not capable of withstanding the severity of our climate without protection. In America and in New Zealand, sparrows, rats, goats, and other British animals, including the rabbit, are naturalised without being acclimatised—the bird and the rodent multiplying to such an extent that the creatures have become nuisances. Plants in England are often naturalised without being acclimatised; hence the circumstance that

many exotics which flourish in gardens do not become wild. A few, however, do thus spread; these become both naturalised and acclimatised. Tropical plants refuse to live in a temperate climate. Certain animals have greater adaptability. The tiger ranges from the equator to the Amoor and isothermal line 32 deg. F.; the mountain sparrow (*passer montana*) inhabits Singapore, Java, and a great part of Europe. Horses, wolves, foxes, and other quadrupeds, have a similar climatic range; so among birds, particularly aquatic birds, waders and several others. Insects are adapted to a very limited range of climate.*

36. With regard to man, the subject of acclimatisation is beset by difficulties. Here are a few. The American race inhabits alike the parts around Hudson's Bay, and the hottest parts of the tropics, the equatorial valleys and lofty plateaux of the Andes. The African of the third or fourth generation in North America, who proceeds to Africa, suffers from the diseases peculiar to the latter climate as does the European. There are theorists who say that the excessive mortality of British troops and British children in India does not affect the general question. I take leave to say that it does so in a very important degree. There is, however, the indisputable fact that white Jews at Cochin have for many generations propagated their kind, and still remain pure in race as when, by their own tradition, they fled from Syria, A.D. 70.† In Southern Africa the Dutch have, during 200 years, thriven without intermixture of native blood; similarly have they flourished in the Malaccas for 250 years. In the Australian colonies, and in America, our own countrymen flourish. But in India, so far as regards the plains, experience is adverse to a similar prospect for the British race.

37. From the particulars now given—and very many more pointing in the same direction might readily be adduced—the grounds are, I trust, rendered apparent upon which I base my conviction that, inasmuch as the phenomena of organic existences, including development, growth, fructification, decay, are in relation to, and to a great degree determined by, climatic, seasonal, and other conditions incidental to particular localities,—so, in respect to man, development, health, functions, disease, death are similarly necessary results of the same conditions as they affect him. To a certain

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* *Encyclopædia Britannica*, Art. "Acclimatisation."

† That is when Jerusalem was captured and sacked by Titus. According to another account the Jews of Cochin settled there in the first year of the Christian era. In 1875 their number amounted to only 1,278 persons.

extent, and within certain limits, he has in himself the power to modify in his own person the operation of those conditions; but he can do no more. Change, constant change, is part of Nature's laws. Whether looked for in respect to atmospheric, terrestrial, or organic creation, it equally manifests itself. As surely as the genial glow of returning spring leads to the recurrence of vegetable life, the summer sun to the ripening fruit, autumn to the changed tint of woodland leaves, equinoctial gales to havoc, more or less complete, among denizens of forests, fields, and gardens, winter blasts to the cessation for the time being of vegetable life—in like manner, and according to their appointed *seasons*, corresponding phenomena occur in the animal world, of which man is the highest *member*.

The CHAIRMAN (Sir J. Fayrer, K.C.S.I., M.D., F.R.S.).—I am quite sure I shall have your assent in most cordially thanking Dr. Gordon for his very interesting paper. (Applause.) When I heard that Dr. Gordon was to read a paper, I knew that it would be a good one, for his great experience, long service in almost every quarter of the globe, and the peculiar interest he has always taken in the subjects he has dealt with, gave great promise of an exceedingly interesting lecture, and I think you will agree with me that my expectations have not been disappointed. (Hear, hear.) We are honoured this evening by the attendance of several distinguished visitors, and I trust that they will consider themselves, on this occasion, members of the Society, and will take part in the discussion which is about to commence. Without detaining you by any further remarks at present, I will ask you at once to open the discussion.

Sir JAMES RISDON BENNETT, V.P.R.S.—I can only express the great pleasure with which I have listened to the paper and my obligations to Dr. Gordon for having afforded me the opportunity of hearing it. There is a great deal in the paper to which we cannot but assent, and I may say, for myself, that I do very heartily assent to most of what he has put before us. The points he has dealt with are, for the most part, of a character that would only justify any expression of dissent from those who have had much more of the individual experience which Dr. Gordon possesses than I can possibly venture to claim. I think there are two or three points of very special interest in connexion with certain matters that have been touched upon, and I may refer to one in particular, with reference to the bearing of Dr. Gordon's views on the general doctrine of evolution—a matter of extreme importance, which ought not to be lost sight of in connexion with that much-discussed subject. Whatever may be our scientific views, we must all of us be more or less impressed with the fact that there is some-

thing associated with climatic and atmospheric conditions which affects us in a very special way, but which does not admit of our assigning any definite cause. For instance, with regard to different diseases which prevail in our own country, we find that at one time a particular complaint is much more malignant than at another time, without there being any other assignable cause beyond those inscrutable differences of season which, to a great extent, are, I am afraid, beyond our investigation. It is probable that varying conditions of magnetic or electric phenomena, with possibly other recondite influences, may have something to do with this; but our appreciation of these conditions must be very much a matter of guesswork. The conclusion, however, to which Dr. Gordon comes in his paper, upon one point, is of extreme importance to us as a nation. I allude to the doubt he has expressed as to the ability of the natives of India ever to attain any material difference or advance on their original physical and intellectual character beyond what they have now reached; the inference being that it is doubtful whether they will ever be competent to hold the country in the way we have hoped they might some day be able to do after the educational influences we have brought to bear upon them. I suppose also, from what Dr. Gordon has said, he equally entertains the view that there is not much probability of Europeans ever being able to stand the Indian climate better than they now do; although, no doubt, the mortality among the European population there is less now than it used to be, in consequence of improved sanitary and other conditions. But I have no views of my own on this subject that I think it would be right to venture to intrude on this meeting.

Mr. D. Howard, V.P.I.C.—The paper read to us by Dr. Gordon is a rather difficult one to handle, because it contains such a vast number of interesting points. It is interesting in what it tells us, though it is somewhat tantalising in regard to the important questions it raises here and there, but which it does not attempt to settle. I will not venture to touch on all the points that have interested me, because I am afraid the time at my disposal would not allow me to do so; I shall, therefore, only allude to one or two. There are several allusions in the paper to an interesting question that has frequently engaged my attention, and that is the question of changes in the characteristics of races. Two most interesting examples are given in this paper, of cases exactly opposite. One is the singular stability shown by a race of the Jewish type—the white Jews at Cochin—who for two thousand years have preserved their characteristics almost untouched by change. Yet, in the very rapid changes that have come over those natives of Africa who have been taken to America, is shown, on the other hand, a singular inability to stand the climate in which their great-grand-parents were nurtured. Then, again, we have the great change which comes over the English race in India, where it is a very rare thing for the third generation to survive without the alternation of a colder climate, which, if it be obtainable anywhere in India itself, must be among the hills of that country. The interesting remarks of the author as to the same curious diversity of experience in the case of plants and the

lower animals, that he has noticed among ourselves, open up a vast field of inquiry, and one would like, if there were time to go through the paper, to follow these out in detail. The whole question is one of great interest, because we find that the Ethiopian type is unchangeable as represented in some of the early sculptures of Nineveh and in the Egyptian frescoes, and yet we know how very rapidly a race may change and lose its characteristics. The subject is one worthy of very careful attention. There is only one other point to which I would refer, and that is the curious caprices of disease, to which reference has been made. If we take the splenetic fever, mentioned in the paper as breaking out in Norfolk, we are struck with its curious recurrence on almost the same day in the year on each occasion. When we remember the experiments made by M. Pasteur, they appear so completely to cover the whole ground that we begin to think we know all about the disease, and yet, when we have read what he has to say, we still find that we are ignorant as to why all the cattle in England do not die of splenetic fever, or why any cattle die of that disease. M. Pasteur has shown how difficult it is to stamp out this disease, and yet it breaks out in this most capricious way. It is the same with regard to cholera, a disease belonging to hot countries; whether it is spontaneously produced by those countries is a question I must leave to the learned to decide, but there is no doubt of its scope and extent, nor that at intervals it invades Europe. It has defied the efforts of all meteorologists and other scientific men to discover the exact causes which produce the widespread infection that again and again have decimated Europe in modern times, just as it did in the Middle Ages. Nor can any one give a reason why the Egyptian plague should have spread through England in the extraordinary manner in which it has again and again come amongst us, producing such terrible ravages. No doubt, dirt and bad habits have had a good deal to do with these things; but still, dirt and bad habits may and do exist without the appearance of cholera or the Egyptian plague; for, if these diseases be the necessary product of places as dirty and badly managed from a sanitary point of view as it is possible to be, then I think that some places I could mention ought to be constant foci of plague and malignant disorders. Here, therefore, I think we are met by an insoluble problem, and it is perhaps well for us to reflect sometimes over these insoluble problems. (Hear, hear.) We ought not to think science so simple a subject, that when we have seen the beautiful unity which runs through the demonstrations of scientific theories we have learned all it is necessary to know. There is a more difficult lesson to be learnt still, and that is, to understand the exceptions. Until we have mastered them, we have only half learned our lesson. We should be crude astronomers if we took it for granted that the planets all moved in regular ellipses, as they are represented to do in the diagrams of astronomy, without studying to attain a knowledge of the laws by which their complex motions are governed, and the reason of apparent anomalies, and, in the same way that a study of these laws is essential to a knowledge of astronomy, so ought we to endeavour

to attain a knowledge of the laws by which this world is influenced. (Hear, hear.)

Mr. Pfoundes.—As I have seen a very great deal of various parts of the world, I venture to offer one or two remarks. The first thing that strikes one after having travelled round the globe several times is, what an immense amount, after all, one has to learn. I am quite aghast when I return home to find that young people, who have so much leisure on their hands, should waste it in various ways, without any attempt to study the interesting subjects so ably put before us in this paper. Even when we go among specialists, we find that, after all, the human intellect is a very shallow thing, and that many of those who indulge in high-flown theories are often unable to answer very simple propositions; while in the East we frequently find people who, with all their want of science, are wonderfully intelligent on many matters about which we, at home, are still groping in the dark. There are two or three points on which I would add my mite to what has already been said. A short time ago, at the Society of Arts, I had occasion to remark on the question of meteorology in various climates, especially with reference to those in which tea and other plants of commerce can be produced. I think there is much useful work yet to be done in directing the energies we employ in the arts of cultivation; the present paper ought to have the effect of stirring one's mind somewhat in this direction. With regard to the question of forest denudation, we find, as has been pointed out, that in Afghanistan there are at the present moment great deserts where formerly there was a fertile country; and the same thing occurs in Australia, where there are arid wastes in spots through which the river beds of former periods are distinctly traceable, and this is also specially noticeable in certain parts of China. In the southern States of America there are immense tracts of land that were once under high cultivation, but which have gone back to their original wildness. I have no doubt it would be possible to bring these districts back to culture, and in this direction the teaching of forestry is a matter deserving of attention. Again, with regard to the question of races, during my residence in the East I have frequently had my attention called to the points mentioned by the lecturer. We find that the Coreans, who have gone among different alien races, have yet been able to preserve the purity of their own for four or five centuries, while there are other tribes that have been enabled to maintain their individuality for a long time. There are a number of other interesting points that must strike all specialists, especially that which relates to our soldiers and sailors abroad. On this subject I would suggest that the conditions of life under which these men are placed are of themselves very often the cause of a large proportion of the disease from which they suffer. If our English people, when they go abroad, would only throw off some of their insular customs, and try to adapt themselves a little more to the necessities of the different climates in which they have to reside, they might escape a good deal of the sickness to which they are subjected; but, if they will continue to indulge in bottled "Bass," plum-pudding, and beef-steak, it is out of all reason to

expect that they can keep their health as at home. The question of climate and horticulture is one that certainly deserves our best attention, and it would be well if we at home could only be made acquainted with the wonderful way in which, in some parts of the world, the patient labour devoted to the cultivation of fruits and flowers produces the most extraordinary results often from only a few square inches of superficial area. I may also draw attention to a very striking circumstance that may be noticed in the Fiji Islands, where, at a certain period of the year, shortly before sunrise, a peculiar slug makes its appearance and furnishes a singular confirmation of what the lecturer tells us in paragraph 24 of his paper. In conclusion I would only say, in allusion to what we are told in paragraph 28, that I hope we shall not be obliged to realise what seems to be there anticipated. I cannot but think that, in these days of increasing emigration, if people going abroad were only properly instructed as to the countries in which they are to live and the occupations they ought to follow, and the diet that is most suitable for them, we should thereby effect a great national good which would redound to the credit and wealth of the country. But at present, unfortunately, people go abroad ignorant alike of the climate they have to encounter, the food they ought to consume, and the occupations they will be compelled to pursue, actuated only by the mistaken impression that they will merely have to pick up gold from under their feet.

Rev. Principal Rigg, D.D.—I feel that the subject of this paper is one upon which no one could be expected to speak with greater authority than Dr. Gordon, looking at the groundwork on which it is based and all it includes; and yet it is one on which a good many persons might entertain some slight differences of opinion from Dr. Gordon and from each other. It is, indeed, a most interesting paper—a paper about almost everything, and one that is exceedingly suggestive and tempting, but about which one cannot say anything that is not more or less complimentary. We must beware, therefore, of the temptation to wander too far afield. I think Dr. Gordon did not touch on one point—though it is possible that I may not have caught it—that I have often thought worthy of more attention than is generally given to it, and that is the degree to which the pre-eminence of mind in any race may limit its variability. For instance, whether it is not merely physical weakness that makes a race amenable to all the influences of climate and so forth, whether the possession of superior mental force tends to preserve a race from being so entirely subject to those influences of climate, soil, and season by which it may be surrounded, as it otherwise would be. I rather think there is a good deal in this idea, and I believe that one reason for the extent to which modern European races, or, at any rate, some of them, are able to preserve their identity under the most adverse and discordant conditions of soil, climate, food, and other circumstances, is to be found in the development of mind and will in those races; that this sets up a kind of barrier against the degree of subordination to the surrounding influences which otherwise would have a depressing effect on them and their descendants in the event of their becoming settlers. I do not

quite understand what has been said with regard to the negro race, but I have thought, and I think I have met with the opinion in some books I have read, that the negro race is, perhaps, as well able to adapt itself to the climatic conditions under which it exists as most races. This may not seem to agree with what I have just said about mind being the great factor in this matter, but I think we may say of the negro race, that if the mind were more developed it would be still more able to adapt itself to all the various circumstances in which it may find itself placed than it is even at the present moment. There certainly does seem to be a singular power of adaptation to exceedingly variable conditions of climate in that race. It does not melt away from the face of the earth as many races do, and, notwithstanding the fact that the descendants of the African negro may become liable to the diseases of temperate climates, we, nevertheless, find that where they become settled they flourish. You will find magnificently grown coloured men in nearly all the northern States, and, although some places are doubtless a little too bleak, yet, speaking generally, they do well throughout the States of America. It may be that when they are sent to the West Indies they are more amenable to the baneful influences of climate there than the British soldiers; but this is possibly owing to sanitary conditions, and not merely to the question of physical adaptation. It is hard to suppose that on the ground of physical adaptation they could be less healthy at the West Indies than English soldiery; and, as a matter of fact, we find that they easily adapt themselves to altered conditions of climate extending over a very wide area in Africa and other parts of the world. So that there are some races which are peculiarly tenacious of life; and, over and above this, I think it worth while to consider whether the mere development of mind and will in various races is not of itself an element tending to keep those races alive? A great deal of rubbish has been talked about race destructibility and race decadence. You cannot go to America, and see the manifest difference of the American type from any type to which you may refer as having been the original type, without feeling that the development of continental influences exercised on the various European races is taking away the characteristics of the original type and substituting a different set. You cannot take the very striking history of the Sikhs without noticing the singular illustration furnished by that race, of national individuality, and yet they are a new nation or race created out of very heterogeneous materials. Thus you see that there is a perpetual melting down of certain characteristics and raising up of others, while our own nation differs very materially in regard to the type that now prevails from the English nation as it was one thousand years ago. All this, however, is very much matter of opinion; but I cannot help agreeing with the remark which fell from a gentleman who spoke a little while ago, and who told us it was a valuable lesson for us to learn, that we ought not to hazard strong assertions with regard to questions of this kind. There are a thousand things with regard to the influences of race, and climate, and diet, and occupation, and mental force, as to which we have no data to go upon,

and which the state of our science is not fit to grapple with at the present moment. (Hear, hear.)

Mr. PALMER.—The chief interest of Dr. Gordon's paper appears to concentrate itself on the pathological effects of climate, showing us that disease is a necessary part of our existence, whether we consider disease as exhibiting itself in the form of organic life or in molecular death. These effects appear to me to be best observed in that most typical disease, the Levantine plague—a disease well confined within geographical limits.

The CHAIRMAN.—Confined to the Continent?

Mr. PALMER.—Normally, no doubt, always so confined, and only traversing those limits under certain well-defined conditions. When we consider what those conditions are under which it spreads, we are reminded of that old Hindoo idea, that sin is the cause of disease, which Dr. Gordon dismisses in the paragraph 7 of his paper; but, if we give it another name and call it perverted moral energy, it may be regarded as a factor quite as important in the propagation of disease as climate. Every considerable outbreak of plague in the world's history has been preceded by extensive wars, and there can be no doubt that this disease is propagated under more favourable circumstances when the atmosphere is affected by the results of the decomposition of animal tissue on a large scale. Every attempt on the part of Russia to enlarge her dominion in the direction of Turkey has been followed by an outbreak of plague. Even those who do not admit war in the abstract to be immoral, or, to go back to the old phrase, sinful, must allow that there has been in its origin some fracture of the laws of morality and justice in order to render war possible. The question is still one of climate; but it is in this case one of changes in climate artificially produced by human agency, and at the present time we are undoubtedly in the infancy of our knowledge as to the possible effect of combined human action in an opposite direction. If man can by his own acts render the atmosphere so deadly as to produce the most baneful results, surely his efforts, rightly directed, might effect a proportionate change in the contrary direction. If hygiene has been in existence as a practical thing for twenty-five centuries, it must have been during a great portion of that time in a very rudimental form. We find, according to Gibbon, that this disease—the Levantine plague—spread in the third and sixth centuries to such an extent as to carry off half the population of the world; and, again, in the fourteenth century the absolute deaths by plague are said to have numbered one-fourth of the inhabitants of the known world, the mortality of some parts of England and France being estimated at nine-tenths of the population! Such a state of things we are inclined to regard as impossible with the sanitary arrangements of the nineteenth century. There is a popular idea on which I should be glad to have Dr. Gordon's opinion. He seems, if I have apprehended him rightly, to endorse the idea that seasonable weather is healthy. Now, this is a question which is still *sub judice*, and there are many who regard the common opinion as a vulgar error. Certainly,

the summer of 1880, in which the mortality approached that of cholera, was seasonable as far as the temperature was concerned. I should like also to have Dr. Gordon's opinion on another point, upon which we have had no very definite or authoritative information as yet; and that is, as to whether the *Eucalyptus globulus* really does exercise the sanitary properties that have been attributed to it?

Mr. A. E. T. LONGHURST, M.D.—The subject of the paper read to-night is one in which for some years past I have felt great interest, and we must all be deeply indebted to Dr. Gordon for having brought it before us. Atmospheric conditions must undoubtedly affect both animal and vegetable life; there can be no question upon that point, for we see the evidences before us in every walk of life. The last speaker remarked that seasonable weather is not always healthy. I think we may take it that seasonable weather is healthy, but that there may be certain local conditions in and around us, in certain seasons, which prevent those naturally healthy atmospheric states from exerting their full sanitary influence upon us—*e.g.*, the living in a crowded atmosphere in smoky cities, undue brain work, insufficient bodily exercise in the open air, &c.; causing an enfeebled state of the nervous and vascular systems, which make us unable to withstand the degree of cold which, as a rule, is no doubt beneficial to healthy people. I think the experience we had of the winter of two years ago will bear out this remark. Then, with regard to the changes that are produced by climatic and atmospheric effects upon the vegetable world these are, I think, if possible, more marked than the changes produced on ourselves. We need not go far to see this very forcibly illustrated at the present moment. If we look at our parks, we find the chestnuts are in many instances in leaf, and in one or two cases in actual flower. This is a state of things we are not accustomed to in the month of March. Certain it is that the existing atmospheric conditions may be considered to be the cause of these phenomena. But, allowing this, I think we must also allow that this weather is due to natural operations, and, I hope, as a rule, it will be found to be beneficial rather than otherwise. As it is now so late, I will not trespass long upon your patience, especially as I find the paper to contain so many points that might be discussed. There is, however, one question I should like to ask, and that is as to the assertion that cholera is localised at Murree and Simla in the Himalayas. It would appear to me, from my memory of service in that part of the world, that cholera could scarcely be said to be localised there. That it occurs there I am sorry to admit, but I am disposed to think it is not indigenous,—at any rate, I hope not. I should like to ask Dr. Gordon whether there is any positive proof of the assertion that cholera may be considered as localised at a great elevation?

The CHAIRMAN.—As the hour is getting late, and as Dr. Gordon has been asked a good many questions, I will not burden him with many more. Still, I suppose that, being in the chair, I am expected to say something. First of all, let me say how much I admire and value this paper, which

contains so many points of interest. As one of the speakers has said, it is about almost everything. There are several points on which it touches that are peculiarly interesting to me, and at any other time—even at the risk of repetition—I should like to discuss them; but, as I cannot do so now, I will merely allude to one or two. I do not consider that pathology, or therapeutics, or anything relating to disease, would have added to the interest of the paper. In fact, such subjects would have been out of place in this Society, and Dr. Gordon had too much good sense to introduce them. The paper has been written from an ethnological, physical, geographical, and climatic point of view, the latter being the gravamen of what is put before us. The question of the suitability of the Anglo-Saxon race for the position it occupies on the great continent of India is a curious and interesting one. In that peninsula, which looks so small on the map, but which really is so large, we are called on to rule two hundred and fifty millions of people, a huge portion of whom are indigenous races—not all indigenous, but importations, like ourselves, of the Aryan stock. We both set out at the same period, one wandering east and the other west. Those of the west have at last joined those of the east again; but how different are the two at the present day! The speaker to whom I have referred said he thought the supremacy of our race over the other was now maintained merely by physical attributes; but I think that this is most undoubtedly not the case, or we should not be holding India at the present time. Physically superior we are, no doubt; but it is not due to physical superiority, but rather to moral and intellectual superiority, that our hold on that country is maintained. How does it come about that Europeans, belonging to the great Aryan race, have become so intellectual and highly cultured, while our ancestors were but painted savages when the Indian people, constituting another Aryan branch, were in possession of the highest culture then existing on the face of the earth? This, no doubt, is greatly due to the effect of climate. The question that interests us now is—Can this European branch of the Aryan race, which has gone to the east, people India and colonise it? Can the race which has colonised so many countries—which has taken so firm a root in Australia and America, and in numerous islands elsewhere—do the same in India? As far as we know at the present time—irrespective of plum-pudding and bottled beer to which allusion has been made—I am afraid it cannot. But still there are great regions in that country along the great chain of mountains, 15,000 to 29,000 feet high, which is shown on the map before me—a range 150 miles in breadth and 400 miles in length, where, on a plateau of from 4,000 to 7,000 feet above the sea, there are districts which the European race may, no doubt, in time colonise. With regard, however, to the greater part of the country, there is nothing to lead us to believe that beyond the third generation the European race, unrecruited from home, could continue to exist. This is one of the great points of interest that I should have liked to have heard developed further by Dr. Gordon; but I do not know how he could have done much more, for he has told us most of what is

known about it. There is another point which has occurred to me, and that is as to the disappearance of races, or rather of large portions of the population from some of the great districts of India. In the north-west corner of India, where Rajpootana and the Punjaub are shown on the map, we have what is called the great desert of India—a region in which we find enormous plains of sand—unproductive districts, with scarcely any population in many parts, and with a rainfall in some years of only three, four, five, or six inches, while in some parts there is absolutely no rainfall at all; and yet in other districts the rainfall is as much as six hundred inches yearly, there being no great difference in the proximity of the hills, and no very great difference in the distance from the sea. One of the causes of this phenomenon has been the deforesting of large tracts of country referred to by Dr. Gordon, who has told us that rivers which once existed have greatly decreased in size; while one historic stream, the Suruswattee, flowing from the southern slope of the Himalayas, degenerates into a series of pools, until, at last, it is entirely merged and lost in the sand. A few years ago I was passing through the Suez Canal, which, as you are aware, was cut through a desert, and while walking on the quarter-deck of the steamer I remember saying to a person who accompanied me, "What is the meaning of those little runlets, those grooves or gutters which I see along the steep sides of the banks? This is a rainless country." But the reply I received was: "No, it is not. Rain falls here now occasionally." This rainfall and vegetation along with it had been brought there by the very fact of cutting the Canal.* We have instances of the reverse of this in India, produced by the removal of forests from districts which were the early seat of civilisation in that country. It was a populous country, but is now a desert. There are many other subjects that I should like to allude to, but must not detain you any longer, and will now call upon Dr. Gordon to reply.

Dr. GORDON.—As a remark has been made to the effect that I have not said all that I might have on the subjects upon which I have touched, I should state that my paper was restricted to one hour in length, and of course, I selected and condensed my subjects accordingly. There have been many remarks made to which, in the short time now at my disposal, I shall be unable fully to reply; but I will do the best I can. Beginning with some of the later speeches, I would refer to a current idea that, if hygiene began at the time of Chakrata, it does not seem to have advanced very much; but, according to the statement I quoted, the condition of the country in the time of the Aryans was such that there were no epidemics,—or they were of very rare occurrence,—while it is said that men lived on an average to the age of one hundred years. Making allowance for a little freedom of expression, it may be inferred that the great majority

*The rainfall at the close of 1880 was so copious, that the verdure which sprang up in the neighbouring desert gave it quite a green appearance. —ED.

of the people lived to a very old age. Another point to be considered is the condition of the people in those days as compared with what it is now. There are many lives preserved now that would not have been preserved then; but I take it that the race of men was much superior in those days to what it is now, and, if I have not misinterpreted the conditions that now exist, I should say that hygiene is carried to such an extent that, although mortality, as shown in statistics, is favourable to us, it gives no criterion of relative physique. I think I may express my belief that physique has not increased to the extent one might be led to suppose by reading the rates of mortality. With reference to the remark made by Dr. Longhurst as to seasonable weather and disease, every person knows perfectly well that certain diseases prevail at particular seasons, and that, if any great irregularity in the seasons takes place, disease is certain to occur. This is, perhaps, more particularly the case in India and other tropical countries, where the variations of climate are almost sure to be followed by outbreaks of disease. With regard to the localisation of cholera at Simla and Murree, I may say that some years ago that disease had not reached either place, but now it visits both those stations with unfortunate frequency. As to the applicability of the actual expression "localised," I am not quite sure how far it is justified; but what I meant by it was, that whereas both those stations were formerly notoriously free from cholera they are now notoriously subject to it. Sir Risdon Bennett has referred to the capacity of the natives of India with regard to the future occupation of the country. I am afraid that on this point I must have made myself imperfectly understood, because the classes to whom I alluded as not being, so far as my opinion goes, capable of advance, includes those who live in the swampy parts of the tropics, the dense jungles and unhealthy tracts, as of the Gaboon for example, and not the natives of India as a whole. As to the chances of British colonisation in India, that is too large a question for me to take up further than has already been done by our worthy Chairman. It is an exceedingly interesting and at the same time an exceedingly difficult question. It is commonly said that the children at the Lawrence Asylums in the Himalayas and elsewhere are exceedingly healthy, but it is quite certain that the greatest care is taken of them; and although, as our Chairman has remarked, we may hope that colonies of British people may become established in the hilly regions, still it very much depends on how far the experience both of these schools and of our soldiers in India will justify our being very hopeful on this point. Several allusions have been made to the mortality of our soldiers in foreign climates, and a good deal has been said about the way in which the English stick to their beef and beer. I find that the different races along the same lines of latitude and longitude live quite differently, and that their manner of life depends upon the natural conditions and productions of the earth, as well as on their habits. The soil in one part of the world will not produce the same cereals that are grown in another part, and even along the same line the natives live very differently. Take, for instance, the line of the tropics, including

America, Africa, India and China, and see how differently the people live. On the coast of Guinea, where I myself have served, the natives take as much beer, and beef, and rum as they can get, but if you go to Ceylon you will find that the people live almost entirely on grain and fish. And if you take Singapore, and so on, you will still find that the line of latitude is no criterion as to the food the people live on. And there is another thing to be remembered with regard to the British race. We must recollect that our soldiers and sailors are British. If they were Indians, of course they could live as the Indians do; but as British people they naturally retain the habits that are natural to the British race, and I think many of us will admit that, when we go to the hotels on the Continent, the change of food very soon upsets us. A remark was made as to the comparative adaptability of the native African troops and the British regiments to the climate of the West Indies. That the black troops suffer more than the British under certain circumstances is a fact not only shown in the statistics, but well known to the experience of any one who has served with them as I have. Take the note to section 28 of my paper. The averages are for the ten years previous to 1879, and the ratios are per 1,000 of the white troops admitted to the hospitals were 911 ; of the Africans, 1,047, showing that there is a great deal more sickness among the natives than among the whites. Then the deaths among the white troops were eleven per 1,000, and among the blacks nineteen per 1,000. Then there were invalided nineteen whites and twenty-seven blacks ; constantly sick, forty-one whites and fifty-four blacks ; and yet the one set of troops was in a foreign climate, and the other more or less in a climate that was natural to them, while with regard to hygiene there is as much care bestowed on the black troops, whether Asiatic or African, as there is on the British. As to the difficult and complicated question of colonisation, there is a peculiar race of comparatively new inhabitants, in what is perhaps the most unhealthy part of the Terai, at the foot of the hills—a people, called the Taroos. They have been there for about two hundred years ; but, although the mortality among them was very great at first, they now seem to be absolutely proof against the prevalent malaria. They are, moreover, the most drunken and dissipated set of people to be met with in that country. Although when I read this paper it was my desire to avoid purely professional matters, nevertheless, as one speaker has made some special remarks from a rather professional point of view, I hope that I may be allowed to give my reply,—I refer to what has been said with regard to M. Pasteur's theories. I suspected, when I wrote the part of my paper referred to, that something of this kind might happen and, therefore, rather than express my own views upon the subject, I have brought with me an authority which I desire to cite. According to the report of a Commission appointed by the Hungarian Government, animals that have been inoculated according to Pasteur's method, if rendered "proof" against artificial charbon, died in increased numbers by other diseases. It is also a question how far the flesh and milk of such animals remain wholesome as articles of human food. In France,

recent inquiries render it doubtful whether this "inoculation" really is protective against epizootic charbon. They further point to the period of "protection" being restricted to eight months. Inasmuch, therefore, as the disease in question only prevails naturally during the months of April to October, any "protection" that is to be looked for appears to have reference only to that period in one year. On the subject of "germs" it is stated by an eminent authority, a copy of remarks by whom I hold in my hand, that the "germ theory" is, in itself, insufficient to account for the phenomena of diseases assigned to it, that "poisons" are secreted by the body itself in disease, that they are formed from within, not without the body. In reference to the same theory, the medical journal now in my hand raises a note of warning against its too ready acceptance. Having epitomised the arguments for and against this theory, it concludes thus:—"We are either on the threshold of a most important discovery, or we are being entangled in the meshes of a gigantic delusion." Time will not permit of my replying to other remarks that have been made upon my paper.

The meeting was then adjourned.

REMARKS UPON SURGEON-GENERAL GORDON'S PAPER.

Surgeon-Major SMITH, 1st G.E.V., writes:—

Bristol, March 17, 1882.

In the main, I agree with Surgeon-General Gordon's well-expressed views of the relation of climate to organic nature; nor can the importance of the subject-matter of his paper be over-estimated, not only as to the physical effect of climate upon man, but as to its mental and moral effects also.

As to the physical effects, we know that the Giver of all Good has fitted the back for the burden, and that "use is second nature" (after vice), and although we know well that Nature's laws cannot be violated with impunity, yet, now and then, she condones the offence and adjusts the matter by the law of accommodation; *e.g.*, the "native" inhabitant lives and thrives upon a diet, and under circumstances connected with his climate, which, to a stranger placed under the same conditions, means, in many instances, speedy and inevitable death. Yet, if the stranger survives, marries, and begets children, the children born upon the soil suffer less than the father did from climatic causes; their children, again, still less than their fathers, until, at length, succeeding generations enjoy the privileges and immunity of the children of the soil, Nature having, in fact, accommodated her offspring to altered states by a gradual process of acclimatisation.

As to the mental and moral effects of climate upon man, I believe it has passed into a truism that the passions of men and women living in hot climates are more easily excited and less readily allayed than those of the inhabitants of colder regions; that life is held at a cheaper rate; and that, often, immediate recourse—upon comparatively slight irritation—to lethal weapons in hot countries, is the rule rather than the exception, cannot be denied.

May not this be due to the cumulative influence of solar heat, producing a latent irritability of the brain and nervous system, which manifests itself on the occasions referred to with sudden, unexpected, and uncontrollable explosive force?

Finally, as a believer in the prophylactic effects of the *growing Eucalyptus globulus*, I would ask :—

May not these so-called malarial fevers, which are said now to have obtained a footing at Ootacamund, be due to water contaminated with organic impurities, or infested with living organisms, which, taken into the stomach, may escape the action of its solvent secretions, pass into the circulation, and produce symptoms analogous to those of malarial fevers ?

The presence of cholera there certainly lends colour to the assumption.

Mr. HASTINGS C. DENT writes :—

There is one sentence in Dr. Gordon's paper to be read next Monday which I think needs qualifying.

At the end of Section 35 :—" Insects are adapted to a very limited range of climate."

I will only give one instance, which tends to show that this is not in every case according to observation :—

The Butterfly *Pyrameis Cardui*, or Painted Lady, is found all over the world, with the exception of South America, where an allied species takes its place. This insect is absolutely invariable, absolutely similar wherever it occurs. I have now before me specimens from Shetland Islands, England, Cape of Good Hope, and India, all exactly similar. Near Hudson's Bay it is also unchanged.

Pyrameis Cardui and *P. Atalanta* (the Red Admiral) are generally found in company, but, while in most cases constant in form and markings, *P. Atalanta* varies more than *P. Cardui*. For instance, near Hudson's Bay, *Atalanta* varies slightly from the general type. In India, *P. Atalanta* is *not* found, but we discover there an allied species, *P. Indica* or *Callirrhöe*, which insect, though bearing a striking general resemblance to *P. Atalanta*, has on some portions of its wings markings similar to *P. Cardui*, in company with which butterfly it is there discovered.

P. Callirrhöe appears, therefore, an intermediate form between *P. Atalanta* and *P. Cardui*, though, as I have stated, the former is not found in India.

Dr. Gordon says very truly, on Section 24, that the occasional phenomenal abundance of insects, at other times scarce, is unaccounted for. *P. Cardui* is a case in point ; some years—for instance in 1881—it is so abundant as to be almost a plague, while frequently the next year it is almost unknown in the locality. I may also mention the beautiful *Chardeas graminis*, the Antler moth, a local insect, which last year occurred in such abundance on Pendle Hill, Lancashire, as to be a source of great alarm to the agriculturists ; millions of the larvæ were destroyed.

I consider Dr. Gordon's paper a very useful one, and it will, no doubt, give rise to an abundance of confirmatory evidence.

REPLIES BY SURGEON-GENERAL GORDON, C.B.

In reply to the remarks by Surgeon-Major Smith, I would observe that there is no evidence whatever to support the theory that "malarial" fevers at Ootacamund are due to any other causes than such as are local or climatic in their nature. I would further say that neither impurities, organisms, nor germs, although carefully sought for in India to account for fever in that country, have been definitely proved to be connected with that form of

disease, in the relation of cause to effect. Nay, more, that the tendency of recent inquiries to seek for such causes, to the relative neglect of such as were by the older medical officers acknowledged as sufficient, namely, season, climate, age, habits, and temperament, have led to very grave and important results. For example, recent statistics show a very serious increase in the rate of mortality by fevers among our troops in that great country.

In reference to the remark by Mr. Dent, I have only to observe that the smallness of the exceptions to the limited range of insects, noticed by that gentleman, shows how very general in its application is the rule alluded to in Section 24 of my paper. The remark by Mr. Dent in reference to the occasional abundance of the insects mentioned by him is valuable. It points to the importance of observations to be instituted on the subject, and it indicates how profitable a field for investigation this branch of natural science presents.

ORDINARY MEETING, DECEMBER 4, 1882.

H. CADMAN JONES, ESQ. IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed, and the following elections took place :—

HON. FOREIGN CORRESPONDENT :—Professor L. Pasteur, F.R.S., Paris.

MEMBERS :—The Right Rev. H. H. Parry, D.D., Bishop of Dunedin ; T. A. M. Gennoe, Esq., India ; J. Stevenson, Esq., B.M., L.R.C.S.E., Ceylon ; J. Williams, Esq., Wales.

ASSOCIATES :—R. H. Bromby, Esq. (life), Victoria ; Rev. W. T. A. Barber, B.A., C. C. C., Richmond ; Rev. H. S. Davies, New Zealand ; Rev. M. G. Goldsmith, India ; Rev. E. Hicks, B.A., Stoke-on-Trent ; A. H. Jones, Esq., Sydenham ; Rev. J. G. Neild, New South Wales ; C. Palmer, Esq., Q.C., Canada ; Rev. T. Phillips, B.A., West Africa ; Lieut. the Hon. H. N. Shore, R.N., Greenock ; Rev. A. Thomson, A.M. D.D., Constantinople ; Rev. H. W. Taylor, New South Wales ; Ven. Archdeacon W. N. Willis, New Zealand ; Lady K. R. Barker, Gloucester.

Also the presentation of the following Works for the Library :—

" Transactions of the Royal Society." 1751 to 1799. *From Rev. Sir T. H. B. Baker, Bart.*

A paper " On the Testimony of the Cuneiform Texts to the Antediluvian period of the Mosaic History," by the Rev. O. D. Miller, D.D. (United States) was then read. A discussion of a general character ensued, after which the meeting was adjourned. Communications were afterwards sent in by Professor Sayce, and other leading Assyriologists, and, as the ancient records just discovered by Mr. Rassam, one of the Institute's Members, throw much light upon the question, the publication of the paper is necessarily postponed.