A RAMBLE IN THE COUNTRY

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As on account of the instability of my health I am shortly leaving the island and my absence will be of uncertain duration, I am offering you this lecture as a sort of leave taking. I have chosen the title in order to admit of my lecture being of a very discursive character and decidedly untechnical. It permits me, in fact, to talk to you in a conversational manner and upon any subject which may be suggested by the objects we encounter in our ramble. Leaving home by the tramcar our attention is called to the advantages of electricity as a means of traction. Yet though part of the noise and dirt accompanying steam or animal traction is avoided it is not altogether abolished but merely removed to another place. Up to the present time we still have to use the wasteful processes of the steam engine in order to obtain from coal or other fuel the energy stored therein. Could we easily obtain the whole energy stored in the fuel the working of machinery could be conducted very much more economically than at present, but hitherto all attempts to do this have been failures. Whether success in this direction will ever be achieved it is beyond me to say, but I see no reason why it should not be so. At present the steam engine is used for the conversion of heat derived from the combustion of mineral fuel into electricity. The most improved forms of steam engine utilize less than half the energy stored in coal while the more wasteful forms, such as the locomotive, scarcely use one-tenth of that power. Both heat and electricity are forms of force and energy convertible one into another. Force is never exhibited except in connexion with matter though force may be transferred in various forms from one portion of matter to another. The mode of action of electricity is singularly like that of a fluid, hence it was for a long time called the electric fluid. Supposing that a tube were substituted for the wire which carries the electricity. Water passing through the tube might act in a somewhat similar manner provided proper arrangements could be made for its action upon the wheels of the car. There is one great difference, however, which is that force, *e.g.* electricity is not subject to the action of gravity while water is. Hence you see that water will not run upwards while electricity will go equally in all directions. The electricity that runs away from the car after having done its work in propelling it is just the same electricity as before and so would water be the same water as before in the like case; but it could not be used to do the same work again without a fresh accession of energy. To illustrate this I will give you another case. Supposing that instead of a tube carrying water or a wire carrying electricity you substitute a rope with appropriate arrangements for drawing the cars (as in fact is done with cable cars) and supposing a string of cars hung on to this rope and being drawn by it, the rope being driven directly by the steam engine and therefore needing no dynamo to convert its energy into electricity; supposing that the load was just such and no less than the engine could carry, then if another car were attached the rope though the same rope with the same power pulling it, would stop or go slower. So if the electricity that runs by the exhaust wire from the cars were put to do additional work an additional strain must be put upon the engine to enable it to do that work. Like a rope, too, the conductor carrying the electricity must be endless: it must either return into itself or it must pass off without obstruction into the general and infinite reservoir of force or electricity: there must be a free outlet or exhaust for it or it could not work. In fact the solid wire acts towards electricity just as an open tube acts towards water. It is but a few yards from the stopping place of the car to the booking office and platform of the railway and this is a great convenience for all who travel often by rail on business or pleasure. But it brings to our mind how much better it would have been in the public interest generally to have had two tram lines instead of three through the town—namely, one passing by the St. Vincent

Jetty and thence up Edward street (and not up St. Vincent street) and the other passing up Henry street (instead of Frederick and Charlotte streets). I have no time now to dwell more on this point (which is rather outside of my subject) beyond merely calling attention to it. The line of the railway as far as the Government quarry is laid upon the land reclaimed from the Gulf forty or fifty years ago. Beyond this it passes over the northern part of the great Caroni swamp. This swamp gives rise to much malaria and renders unhealthy all the country within its influence, so that it may well be doubted whether it would have been to the public interest to have given encouragement to the running of a tramway along the Eastern main road whose course is at a short distance north of the swamp. It seems to me that much more has yet to be discovered and made known on the subject of malaria and the mode of origin of the fevers produce thereby. I have alluded to the question in treating of Gaspari in my paper on the Gulf of Paria (Proc VI. 1894, page 109). The agency of mosquitos in spreading malarial disease was discussed by us so long ago as 1865 and in my paper on the cultivation of scientific knowledge, read in 1867. I referred to some investigations upon the subject of the action of swamps upon the production of malarial fever. Our experience of a month's residence at Gaspari in 1891 does not bear out the mosquito theory fully. Every one of us, including a lady who never before or since had malarial fever, was seized with it tho we had efficient nets. I have given my views on the subject in the paper before quoted. The most characteristic vegetation of the salt swamps is the mangrove which keeps its footing so far as the slightest influence of the tide is felt. Mangroves grow only between tidemarks from the highest high-water to the lowest low-water and will not live beyond these limits whether above or below. The line of demarcation of the salt swamp is very pronounced and wherever the fresh water has undisputed sway, rushes take the place of mangroves. The remains of the abortive attempts to grow coconut palms in this swamp have almost entirely disappeared. It has been a very favourite opinion that coconut palms will grow in salt water. But as a matter of fact they will not grow in swamps or anywhere where their roots are not thoroughly drained. They readily tolerate salt water so long as this condition is secured. Equally will they fail if planted on limestone (as mentioned in my paper on the Gulf of Paria already quoted). You will see at the Bocas Islands coconut palms growing in the little bays where there is an accumulation of a certain quantity of gravel and in some of the more favourable spots a few trees may ripen their fruit. But as a rule even those trees that bear fruit never ripen it and in any case wherever the roots come into contact with the limestone the palms die. Any person may notice the scarcity, if not absolute absence of palms, on all these limestone islands except in the few spots where gravel or sand occurs. When palms are planted on the limestone or in swampy places, as is often done, they grow to a certain height, greater or less, and then gradually dwindle away. And this dying-away of the palms, coconut or other, on limestone or in swamps or under other unsuitable conditions is called "Bud Disease." And this, though caused by unsuitable soil and conditions, is attributed to the action of caterpillars or fungi or other parasites or saprophytes. It is the case, however, that the enfeebled plant is speedily attacked by such organisms which finish the ruin begun by adverse conditions. Botany is a subject which everyone ought to cultivate and if our systems of education were sound some elementary knowledge of plants would not be beyond the abilities of the milkmaid and the ploughboy. I shall say more on this subject just now, but here I am going to confine myself to what is immediately before us. Close by the station where we alight from the railway train are some plants of cotton with ripe pods. It is evident that the cotton plant takeskindly to this soil although it is of a poor quality. Many of the smaller landholders have on their holdings portions of land which might be utilised for cotton culture and the picking and cleaning of the product could easily be done by the peasant in his leisure time. A model of a very efficient small gin such as could be made by any bush carpenter was presented to the musem, but as it was not interesting to the ruling classes it was hidden away or destroyed as everything for the real benefit of the people is in Trinidad. Here you will pardon me a slight digression relative to the word "Gin" which is a mere modification of the word "Engine" and illustrates a common phenomenon in the growth and origin of words and language. The cotton plant is a mallow and the order of which it is a member is usually easily recognised by the structure of its flower. The garden hibiscus, so much in demand for its showy flowers of varied hue is a good type and owing to its large size easily examined. Some of our common weeds belong to the order as well as the ochro, the sorel, the cousin maho and other well known plants. You may see here one advantage of a knowledge of plants No plant of the order of mallows is poisonous and if one can certainly recognize a plant as belonging to the order he may be safely assured of its non-poisonous properties. Most persons recognize the difference between exogens and endogens without much difficulty though there are some plants which at first sight seem not easy to place. There is no difficulty when we come to deal with orders especially of exogens. The order of mallows, of which I have just said something, is easily distinguishable by its flowers. Another order—the melastomas—has a very characteristic venation of its leaves whereby one can scarcely fail to recognize at sight a plant of this order. With very little practice a plant of the bean order is readily known by its fruit or flower though some, like the Angelin, have a fruit not immediately recognizable as being like that of a pea. The foliage of plants of this order is very diverse in structure and if the pinnate form is often characteristic it may be said that there are many exceptions; and when we come to sub orders like those of Mimosa and Caesalpinia the characters of the flowers may be puzzling. A very remarkable plant which we sometimes find growing on waste or abandoned land is possessed of a feature which recommends it to notice: it has the property of developing young plants from the margins of its leaves. The name of this plant is Bryophyllum—and that I had much trouble to find out—it is commonly called "Wonder of the World," but that is a name I have not found in any book Few plants have this property of producing young plants from the margins of its leaves, and this is remarkable from its physiological and embryological portent. The ovary of a plant which in most cases becomes the fruit or forms part of the fruit is made up of one or more carpels, as the botanist calls them. These carpels are modified leaves and bear upon their edges just as this Bryophyllum does growing points which, when the ovary is developed, take the form of ovules and these when fertilized by the pollen become the seeds from which future plants are developed. If you could fold the margins of the leaf inwards and fuse them together so that the growing points were turned inwards towards the central part or axis of the ovary you would have a typical example of that organ. But this is not a lecture on Botany, so I have to leave this subject with the remark that the flower of this Bryophyllum is of itself very remarkable having four (sometimes only three) separate carpels each with a very long style and eight (or often seven) stamens, the whole inclosed in a tubular corolla which is again inclosed in a kind of campanulate calyx. These floral envelopes are quadriparite. The rule of five prevails generally among exogens, but there are many departures from and exceptions to this rule and this is one of them. We must leave the station yard or we might find matter to keep us there all day even if we confined ourselves to the botanical department alone. Most of the ground is covered with ordinary weeds, but an array of cultivated shrubs and flowering plants brightens up the space adjoining the platform which we now leave and pass on to the main road which we have to cross in order to pursue our excursion. In doing this we observe heaps of road material piled by the side of the road in readiness for repairs. On examination we find these to consist chiefly of the light-coloured compact limestone quarried in the neighbourhood of Port-of-Spain, some of which is veined with calcite, the latter being the portion of the limestone dissolved out by water and deposited in veins and fissures of the rock. Nearing we find some fragments of a material closely resembling at a cursory glance this calcite. This on examination turns out to be milk white quartz. Here an elementary piece of mineralogical knowledge comes to our aid to enable us to distinguish the difference and shows the value of even a smattering of such knowledge. Had we some acid with us we might apply it as a test: for the limestone and its included calcite would effervesce freely with it. But we have no test at hand except our knives. These will do very well: we scratch the limestone and the calcite with a penknife and the result is a streak of white powder, while the same operation performed on the quartz fails to scratch, but leaves a dark coloured streak of metal on the stone Of course, the cleavage and crystalline forms are sufficient to the eye of a mineralogist without even the use of a simple test such as I have given to determine the difference between quartz and calcite. The piece of calcite I am now showing you [illegible] actually [illegible] so it [illegible] with the [illegible] one [illegible] character [illegible] of [illegible] by [illegible] silica [illegible] sand and [illegible] dissolved and [illegible] the rock [illegible] it. The [illegible] solution [illegible] different [illegible] specimen [illegible] beach, [illegible] others parts [illegible] beach formerly raised [illegible] dle of the [illegible]

It is now [illegible] journey up the [illegible] almost due [illegible] the valley [illegible] immense dam [illegible] think that if Louis A[illegible] had [illegible] Trinidad he would have declared th[illegible] or dam to be the terminal mo[illegible] of a glacier which once occupied the valley. I cannot hold that opinion: still I will call such banks where they occur by the name of alluvial moraines. They do not occur in the valleys west of Port-of-Spain, but they increase in size and importance in the valleys eastward of Port-of-Spain at least as far as the valley of Aruka. At the mouth of the Santa Cruz valley the alluvial moraine is widely dissected by the river, and the old road to Santa Cruz avoided it by keeping to the right and crossing the river, the new road (made about 1860 under the superintendence of Sylvester Devenish) going up and across the moraine. The town of St. Joseph is built on the alluvial moraine of the Maracas valley and the capital of Trinidad ought to be built on that of the Caura valley (Eldorado) which is one of the finest and healthiest sites for a town in the island. These alluvial moraines are the remains of deposits of gravel, sand and clay brought down the valleys by denudation or erosion and deposited at their mouths at the time when the gradient to the sea level was lower than at present—that is before the great subsidence took place which formed the Gulf of Paria and caused the pluvial waters of the western half of Trinidad to flow westward instead eastward. The alluvial moraines are therefore the result of, and part of, the evidence for the earth movements I have described in my paper entitled the "Growth of Trinidad," to which I refer for further particulars on the subject. In reference to the new road I spoke of, it is not difficult to perceive that the advantage conferred by it on the valley of Santa Cruz could be repeated in the case of the Maracas and Caura valleys by the construction of a highway on similar lines. But I suppose that the interests of the San Juan people were not strong enough to oppose the making of the road to Santa Cruz whereas those of St. Joseph, Tunapuna, and Tacarigua are too strong to allow of such improvements for the Maracas and Caura valleys. It is another instance of how the public interest is often postponed to that of individuals. Parenthetically I may recall to your memory that the specimen of gold I exhibited in this room some years ago came from a boulder found in one of these alluvial moraines. The valley up which we go is narrow in its lower portion and may be likened in cross section to the letter V. This feature, though of later geological date, is dependent upon the same circumstances as the existence of the alluvial moraines and like that it becomes more pronounced as we go east: the lower part of the Maracas valley being more clearly V-shaped and the Caura and Aruka valleys still more so. The Santa Cruz valley on the other hand is more U-shaped. But as we go further north up the valley we find it to expand in width rather suddenly. The causes of this phenomenon have been described by me in my paper published by the Canadian Institute and expounded by me in this room on June 3, 1905. To gain some idea of the enormous amount of denudation which has taken place in these northern mountains we must take our stand at some distance to the south of the line of their base. Then looking north and carrying an imaginary line from peak to peak at some height above their present level and imagining all the space between this imaginary line or rather plane and the bottom of the valleys to be filled up with rock we can see more or less imperfectly what a quantity of matter has been removed to form these valleys. Taking the sea level as a base, the quantity removed is indeed far greater than what remains. The immense quantities of matter thus removed by denudation in various parts of the world so staggered geologists that they sought to explain the phenomena by means of universal deluges and cataclysms. Such ideas are not even now wholly exploded, but geologists are generally satisfied to seek in existing causes a sufficient agency for the purpose. though it may be admitted that change of climate or other circumstance may have in some cases had more or less influence. It is only the continued action through long ages of comparatively small forces that is really efficient to produce such results. But there is a circumstance which appears to me to have been largely overlooked by geologists—that is the immensely heightened effect of water when charged with mud. When you see the ordinary little clear brooklet trickling along the bottom of its valley it seems incredible to you that so small and feeble a thing should be able to scoop out that comparatively large and wide ditch. And ordinarily when the water is clear the erosion of the stream is really nil or almost so and is chiefly confined to carrying off matters such as lime, etc., held in solution. But when the heavy rains of the wet season come and the swollen river with its waters charged with mud rushes down, the quartz boulders are rolled along like mere trifles and large quantities of sand and gravel are carried away: in the process eroding the banks at every turn and thus securing a fresh supply of detrital matter. The operations of the apparatus used in alluvial gold-mining and called the "longtom" are interesting when viewed in connection with the effects of water holding mud in suspension. This apparatus consists of a wooden trough about 18 inches or two feet wide and nine or ten or more feet long, its lower end closed by an inclined metal plate pierced with holes of about an inch in diameter. Underneath this perforated plate is placed a box called the "ripplebox" consisting of two or three divisions supplemented perhaps by a blanket or a small trough containing mercury; the object being to retain any gold that may have passed the ripplebox. The way of working this apparatus is for the gold-bearing stuff to be placed at the upper end of the trough which is slightly inclined; a stream of water is then directed upon it and it is stirred up with hoes. This causes the mud and clay to be quickly carried away, the water passing through the holes in the plate and carrying the finer gravel and sand into the ripplebox, where the particles of gold fall to the bottom and are retained by the divisions of the box which is filled to a depth of two or three inches with sand and gravel. As long as muddy water flows into and through the ripplebox the sand is kept in a loose state and the gold easily falls to the bottom. But if at any time owing to a stoppage in the supply of fresh material the water becomes clear the sands quickly sets or hardens and if then fresh material is brought in and the water becomes muddy again the gold does not sink into the material in the ripple-box, but it and the gravel and sand are carried off over the surface of the former deposit. Clear water, therefore, causes the settlement of gravel and sand while muddy water keeps it loose and in an active and lively state, greatly promoting the rapidity of removal. The cause, of course, is the greater specific gravity of muddy water, the gravel and sand consequently almost floating in it and being thereby rapidly moved onwards by he current. Such accidents as the San Francisco and Jamaica earthquakes, as well as those which have occurred on the west coast of South America, are in part—at least —due to subsidences and dislocations of portions of the earth's crust, largely produced, no doubt, by the removal of portions of matter from one place to another, chiefly caused by rain and rivers, although possibly also by withdrawal of molten material beneath or in the crust of the earth. Thus you see that the enormous mass of matter which has by the operations of denudation been removed from these valleys and deposited somewhere else must have caused a disturbance of equilibrium just as happens when you remove a weight from one scale of a balance and place it in the opposite one. But all such accidents are naturally more prone to take place along lines of weakness in the earth's crust, and such lines of weakness are often shown by dislocations, faults and depressions below the general level. The Gulf of San Francisco is situated on such a line of weakness, so also is the harbour of Kingston, Jamaica. The south west portion of the island of Haiti exhibits another remarkable instance of a line of weakness whose depressions are shown by several lakes, laguns and bays extending from Bahia de Neiba to San Mark channel to the north of Gonave Island. Another equally obvious line of depression is that which extends from the Bay of Samana in the north-east to Bahia de Manzanilla near Monte Cristo in the north of the said island. And that this last great depression called generally Lavega was under water in tertiary times is proved by the extensive development of miocene formations along its margins with an extremely rich and characteristic fauna of molluska, corals and foraminifera. Such depressions are a common feature in the earth's surface and we have some in our neighbourhood, such as the Gulf of Paria already mentioned and of which I have treated in several papers, notably in that one entitled "The Growth of Trinidad," which Mr. Hart has so severely criticized in his bulletin. Whenever I want to have a laugh I turn to this criticism of Mr. Hart's. Nevertheless it shows how necessary it is to express oneself clearly and to explain fully the matter in hand. It is so with my statement of the existence of volcanic dust in the oceanic beds of Naparima. It is not that such dust does not exist elsewhere, but that it is masked by the much large quantities of sand and gravel in which it is disseminated. In the oceanic beds the calcareous mud in which such dust occurs is easily washed away, leaving only the heavier material, including particles of volcanic dust among the residue. Mr. Hart informed me when discussing this subject that he had evidence that Trinidad was never joined to Venezuela. I strongly urged him to bring forward this evidence which would, whether conclusive or not, be highly interesting and might elucidate some points in the geological history of the island. I may here refer to the existence not far from us of another line of terrestrial weakness which in some respects resembles that I have mentioned in the north part of Haiti. It is that depression in which occurs the Gulf of Cumana or Cariaco and which may extend on the east to the Gulf of Paria and on the west to Caracas, and it may possibly be one with that depression which is marked by the Lake of Valencia. And the fossiliferous and lignitiferous beds of Cumana and its neighbourhood are probably a continuation of the tertiary series of Trinidad (called Caroni series in the geological report 1860). Further, I suspect that the area about Cumana marked on Wall's map of Venezuela as cretaceous includes tertiary as well as cretaceous rocks. I have a series of well-marked cretaceous fossils from that locality besides the completely distinct tertiary fossils described in the Journal of the Geological Society 1866. Many of these tertiary fossils are of the same species as those known from Haiti and Cumana. Further, I think that the region about Cumana presents a remarkable geological resemblance to Lavega de Santiago in Haiti. It can scarcely be said that landshells are abundant in any part of the country we are supposed to be traversing. Yet a few species are found on the ground and under dead leaves, etc. These are all small and inconspicuous; but two larger kinds are found on trees bordering the way; they often æstivate during the dry season in forks and hollows of the trees. One of these has some resemblance to an African type, though on examination it proves to be different. Another remarkable shell whose aperture bears some resemblance to an ear belongs to a type peculiar to South America called Plekocheilus by Guilding. The type species Bulimus glaber is an inhabitant of Brazil, while allied species are found in Venezuela. Of the species called *glaber* three forms occur, one in South America, one in Trinidad and one in Grenada. The examples from each locality are distinguishable and may be called geographical races, and as such they are indeed incipient species. It is thirty years ago, at least, that I enunciated the theory that species in many if not in all cases originated somewhat suddenly, and this is brought about by migration or isolation of individuals. All individuals have some tendency to vary from the type and the tendency to vary in particular directions is inherited. It is usually kept in check by constant interbreeding among the individuals of the species. But when a pair or set of individuals become isolated their peculiarities become more pronounced and developed so as to originate a new species. When in the course of migrations and changes forms come together again they appear as distinct or allied species. An extension and repetition of this process leads to the production of what are called genera, orders, classes and other divisions and distinctions all of which, to be true and valid, must be based on genetic relationship or "Descent with modification." An exactly similar process of evolution has taken place in the domain of Mythology, where stories have branched off from the main stem of solar mythology migrated to different tribes and regions, and when they get back in course of time with names and minor details altered they are considered as quite distinct stories from the more direct descendants of the original stem, though to the mind of the expert the fundamental character by which the story is recognized as a solar myth remains unaltered. (See Cox's Aryan Mythology and Max Muller's Chips and Lectures.) Habit, as you know, is inveterate and heredity is only habit. I wish to illustrate this by the case of univalve shells which, as you are aware, are spiral or wound together, the winding being usually what we call dextral—that is if the shell be placed before us with the spire or apex uppermost and the aperture (which is really the anterior part of the shell) at the base then the aperture will be on the right hand. This means a greater development of organs on the right hand side of the animal than on the left. This conformation is the rule with univalve or gasteropod shells, but like all other rules it has exceptions. A few genera, like the freshwater Physa, are constantly sinistral; some genera have sinistral species and very many species which are normally dextral have occasional sinistral varieties or individuals. The habit of winding dextrally is thus all but universal among Gasteropoda, while a few of them have the habit of winding sinistrally and a very small number are able to break through the habit of their species and to wind in a different manner. A few worms construct shells which wind indifferently either way. Foraminifera, which are exclusively aquatic animals, differ from molluska in not being furnished with separate organs or limbs: thus they have no stomachs, hearts, livers, heads or legs, and though their sarcode body is differentiated to a certain extent so as to enable it to perform the functions of the organs named and others, their organization is of a lower and simpler type. The shells of the marine foraminifera are often very like those of mollusks for which they were long mistaken and like these they are often spiral, but they rarely show any constancy as to the direction of enrolment, being as often sinistral as dextral. Since the occupation of these valleys and of the island by Europeans the fauna and flora have become greatly modified. The primaeval forest reigned formerly over all these hills and valleys from the Bocas eastward where now scarcely a trace of it remains, the vegetation that you see on the hills being mostly rastrajo or second growth. On Punta Gorda we have found a fossil land molluskan fauna now only to be met with in the recesses of the mountains, say the Cerros of Aripo and Oropuche. The mammalian fauna has altered also: we no longer have the wild cat and the monkey, which have retreated to the farther parts of the islands and are there in process of rapid extermination. The quank and the lap have followed, but we still have the opossum and the aguti. The tree porcupine and the iguana remain also. Talking of monkeys their relationship to man is not quite so close as many fear. The ancestor of man is not a climbing animal, but a cave-dweller. This is shown by the structure of his feet in which the hallux is not opposable as it is in the monkeys. Recent discoveries in France and Spain have greatly extended our knowledge of prehistoric and cave-dwelling man and have shown that he cultivated art and was able to use artificial light for the pictorial adornment of his far-underground dwellings. The pictures include coloured drawings of recognizable ancient and extinct animals. I have often thought that we might discover prehistoric remains in some of our caves, and perhaps such may yet be the case

And now, having finished our ramble, and having embarked on the train on our return home, I will utilise the time with your permission in presenting a few remarks on the cultivation of natural science—that is, of the knowledge of nature. In 1867 I read to the Scientific Association of Trinidad a paper on the cultivation of scientific knowledge, taking as my text the book of George Henry Lewes then recently published entitled: "Aristotle—a chapter from the History of Science." I thought, indeed, that that paper was dead and buried as someone had asserted of all the work of the Scientific Association, but nevertheless I find it quoted in a paper on the geology of the West Indies written in 1895 by J. W. Gregory, now Professor of Geology in the University of Glasgow. What I said in that paper is for the most part as pertinent now as when I read it, but on this occasion I wish to reinforce what I then said. As to the progress of humanity I do not feel so sanguine as many profess to be. It may be possible that there has been some improvement during the last hundred years—that is in respect of the diminution in the amount of vice and crime, but we have none the less to maintain a continual warfare against the powers that work for evil. In some respects there has been a great advance, but it has been almost wholly in the direction of material civilization, such as manufactures and products, engines and machinery, railways and telegraphs. It may be doubtful if material improvement is of much use without a corresponding moral advance. I believe in the practicability of an immense improvement in this direction. By the use of the instrument of verification which I have referred to we have ceased to believe in many erroneous ideas such, for instance, as that barnacles change into geese. Other erroneous beliefs still linger among us as, for instance, the marvellous colours said to be displayed by dolphins when dying. The ground work of this belief is a solar myth referring to the gorgeous hues accompanying the setting of the sun. And solar mythology has been fruitful in beliefs of this sort. In a recent book about business (Shadwell's Industrial Efficency) I saw it mentioned that one of the requirements for business success is freedom from fetichism. How is this to be secured without the study of nature? I am sure that in the present state of things the only means of combating the evils with which we are surrounded and of eventually gaining the upperhand over them lies in the general cultivation of a knowledge of nature. And this pursuit, viewed only as a means of recreation, is capable of giving us good results as any other. Its results are always beneficial to the body as well as to the mind, but its great value is in the inculcation of the truthful habit. And when this is attained and assured crime and misery will attain their minimum. In the present state of this colony having a population not absolutely large yet large in proportion to the size of the island its social condition, its cultivable capacity and in proportion to the means of subsistence as shown among other things by the very large quantity of foodstuffs it is necessary to import, a population moreover extremely backward in most respects and rapidly deteriorating at least morally if not physically, we cannot afford to lose any means which tend to the improvement of the people. The true object of such an institution as this is not the gratification of any popular taste or fancy, or even the providing means of aiding persons to acquire at a small cost arts and handicrafts whereby they can obtain a higher rate of pay than they could without, nor again the provision of means of popular amusement at cheap rates. What is required is means for the moral elevation and intellectual improvement of the people; and this fact must not be lost sight of. Indeed one of the great obstacles to progress here, as elsewhere, is the difficulty of getting people to recognize the real and true means of improvement and the real obstacles to such improvement One symptom of the retrograde state of the colony is the resolute suppression of everything tending to the elevation of humanity. Where suppression is not practicable perversion is resorted to and thus our institutions intended for the benefit of the people, are rendered useless for the amelioration of the community. The point of view of those who despise and contemn Natural Science is exemplified by the statements of the Russian Procurator-General Pobiedonosteff, who has described parliamentary institutions as "one of the greatest illustrations of human delusion" and as "the supreme political Lie that dominates our age." In making these statements, Pobiedonosteff was, I am sure, quite sincere. That is the view taken by his school and on the surface it would appear to be just as likely to be right as any other view. His expressions did not, of course, refer to the cultivation of natural knowledge, which is my present subject: yet as they appertain to the dogmatic and authoritative side of human opinion in opposition to the positive and progressive side they serve to illustrate my argument and are a fair representation of the views of those who oppose our institution and who are inimical to freedom of thought and of political action. To such persons it seems that if people were taught such things as I am now advocating—that is, if the study of natural knowledge were encouraged—that the foundations of human society would be overturned. I do not participate in any such fear. I believe that the study of natural knowledge and the pursuit of truth would tend to the advancement of humanity in happiness as well as in wealth and prosperity and that no class or order of society would really lose anything thereby. Views and opinions having a similar tendency to those I now enunciate were set forth in my paper on the Victoria Institute (see Proc. VI, 1897 p. 181—182) and were very favourably noticed by the Governor of the island, patron of the Institute, Sir Hubert Jerningham (see Proc. VI., 1899, p. 338—339). A too common error which I may here notice is that if we provide at the public expense for the employment of a botanist, a chemist, a geologist and other officials whose functions involve the use of scientific knowledge that we have done all we need do in this direction, and that we are thereby exonerated from any further development of such knowledge. The growth of this idea is carefully fostered by those who are opposed to the education and elevation of the people. But this is no substitute for what is really needed. It may be likened indeed to what would be the case if we had schoolmasters without schools or scholars. Taking the expression "geology" to include the history and natural history of the earth and, therefore, to comprise a full account so far as practicable of all man's surroundings the remark I quoted respecting the importance to the people of that study in my paper on the Sangre Grande borings (Proc. VI., 1903, p. 7), the gist of which is that the study of geology is of more importance than that of any other kind of knowledge outside, of course, of the usual elementary subjects which are rather the machinery and tools of knowledge than knowledge properly speaking. The real test in the affairs of life is indeed that contained in Matthew vii. 20, but as I am not now concerned with political or social questions I shall refer to the test which is applicable in all matters of natural knowledge, that is the test of verification. It is this test that is required for our present use, and it is this test above all questions of mere utility that constitutes the great value of the cultivation of natural knowledge. Truth, indeed, is that which is veritiable, and though this is not a definition of truth it is the character of it. It may not always be possible to verify the truth of a proposition. But every truthful proposition must be at all times open to verification, and if it is not susceptible of verification it cannot be received as truth. The question of making provision for the cultivation of natural science and for a museum and scientific institute of some kind was for many years before the Government. The earliest mention of the subject is probably forgotten ; but we find a reference to it in the transactions of the Scientific Association of Trinidad 1864, page 43, and again in the proceedings of the same society 1867, page 88. About that time the colony had come into possession of Leotaud's collection of birds. Keate's collection of shells only awaited museum accommodation, and to these were added Court's collection of reptiles (unfortunately unnamed in which state they continue until this day). As a temporary measure these collections were lodged in the Council Room at the Government buildings. But in 1886 Governor Sir William Robinson recognizing the urgency for some provision being made for the suitable housing of these collections and the establishment of a scientific Institution in connexion therewith, took advantage of the movement for the erection of a monument in commemoration of the Jubilee of Queen Victoria's reign to give such monument the direction of an Institution of that kind. The Institution which arose out of this movement was called the

Victoria Institute and the building for its accommodation and for the housing of the collections was styled the Victoria Museum. The Institute was designed for the propagation and cultivation of scientific knowledge, including applications of such knowledge. Further particulars on this point will be found in my paper of 1897 read to the Victoria Institute and published in their proceedings, and to this I beg to refer all interested in the subject. Notwithstanding that the statements and propositions contained in that paper received as I have said, the hearty support of Governor Sir Hubert Jerningham they have been quietly ignored. Hence the Agricultural Department and the Natural History Society are separated from the Institute to the great detriment of the work of all. Also the collections have been removed from the places assigned to them to make room for schools and classes. It follows from what I have stated that natural science having the first claim upon the funds and attention of the Victoria Institute that it is not until these claims have been satisfied that other objects are entitled to a place. In this country there are plenty of means provided for sports and pastimes and means are not wanting even for the teaching of the subjects taught in the classes provided by the Institute for business and commercial purposes. But this Institute is our only means for the development of natural knowledge and its extension among the people and that is a matter of national and not merely commercial value. As bearing on the necessity of means for developing and cultivating the morality, intelligence and intellectual energy of the people at the same time as and in furtherance of their commercial and material advance I will conclude with extracts from a speech of Mr. Chamberlain's and from an article in the *Journal of Geology*.

EXTRACT FROM SPEECH OF JOSEPH CHAMBERLAIN, JAN. '06.

The wealth of the country is increasing. Exports are larger than they ever were before. But I ask you to think is that all you have to look to? It is not merely a question of the wealth of the country, it is a question of its welfare. There was a celebrated statesman an old free trader and economist, Adam Smith, who believed in free trade and free exchange but nevertheless told his countrymen that defence was greater than opulence, that is to say that the object of a nation should not be only to increase the aggregate wealth but it should increase the general happiness.

EXTRACT FROM "JOURNAL OF GEOLOGY, 1907," NO. I.

"But above all intellectual economics should not escape recognition. The intellectual wealth of the nation is its greatest wealth. The contribution which intellectuality has made to the present material prosperity even if we weigh nothing higher is perhaps its greatest contribution. Large as are our native resources they would yield a relatively small return to our people were it not for that acute mental activity, that signal intellectual power and that abounding sagacity which so distinctly characterize the present industrial evolution. This intellectuality lies not so much in the mere possession of technical knowledge as of insight, constructive genius, and aggressive mental energy; and these are fostered more effectually perhaps by the influence of independent original research, by the modes of thought and the spirit of investigation than by any other single agency.

By as much as these intellectual possessions are our greatest assets by so much a failure to promote them in the most effective manner be the greatest of economic shortcomings whether on the part of an official organization or of a University.

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