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HAMPSTEAD NATURALISTS' CLUB

THIRD

ANNUAL REPORT

PRESIDENTIAL ADDRESS

List of Members

RULES OF THE CLUB, Etc.

BRITISH MUSEUM NATURAL HISTORY

HAMPSTEAD

April, 1883

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NATURAL HISTORY

HAMPSTEAD

APRIL, 1883

Hampstead Naturalists' Club.

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ORGANIC EVOLUTION:

BEING

The Presidential Address

DELIVERED BEFORE THE HAMPSTEAD NATURALISTS' CLUB AT THE CLOSE OF THE SESSION 1882–83,

BY WILLIAM BOULTING, L.R.C.P.LOND.

An annual address, in order to be orthodox, requires that the president should both congratulate his hearers on the success of their society, and review the recent history and present condition of that branch of learning which they profess to pursue.

The history of our society during the past year has been one of undoubted progress. Our numbers are nearly doubled; our museum has been markedly enriched; and we have not only enjoyed the fellowship and help of many members, including such well-known names as Professor John Morris and Professor Rudler, but we have secured "noctes instruentes" from several non-members of scientific note. We must all feel regret at the unfortunate but unavoidable resignation of our indefatigable secretary, although we are happy in securing the services of his equally indefatigable brother. Beyond this there is little to chronicle, and we are so far in the position of that favoured nation that hath no history.

In the past year there has passed away from the presence into the memory of man the greatest scientific mind of this century, and perhaps of any age. His work was so thorough, so varied, and so comprehensive; his power of generalization was so massive, that it will take science centuries to follow to their ultimate deductions, and complete, the lines of inquiry included in what may well be called the Philosophy of Darwin. The modesty, the dignity, and the forbearance with which he wrote silenced even the revilings of those who hated because they feared. And it is due to the calm and temperate conclusiveness of his reasoning that the profoundest revolution to be found in the history of thought has exhibited so little of that acrimonious fervour and bitter partizanship that is so painful and so injurious to the progress of truth. Alike in his character and in his works Darwin was

"Gentle and meek, and affable, and mild,
Patient of contradiction as a child.
Such was Sir Isaac, and such Boyle and Lock.
Your blunderer is as sturdy as a rock."

Considering the magnificence and solidity of the genius of our great dead naturalist, and how completely it covered the whole range of the Natural History Sciences, it appeared to me that the annual address from the chair was an opportune occasion for a review of the whole subject of Evolution in its bearings on organic life.

The present century has made even more progress in pure science than in its practical application. Striking as are the steamship and the railroad, they are less striking than the thoughts that shake mankind. And, what is still more impressive, is that sense of transcendent order which has come to occupy the void of uprooted opinion. The discovery of the indestructibility of matter by the chemist, the discovery of the indestructibility and transmutability of force by the physicist, have paved the way to, and indeed helped to suggest, the doctrine of the continuous descent of living forms. We have come to regard the universe from a less parochial point of view. Whatever philosophical speculations we may indulge in, whatever may be the nature of that insoluble, awful mystery of Being, this much, at least, we may safely affirm that we know—that the universe is self-sufficient and self-regulating, the aggregate phenomena of an Unbroken Order. This knowledge is what we mean when we speak of evolution. Evolution is orderly development, while the application of the doctrine of orderly development to the elucidation of certain problems of organic life is spoken of as Organic Evolution.

Speculations approximating towards the idea of evolution are to be found in ancient Indian philosophy. Of the early Greek physicists, Anaximander conceived the heavenly bodies to be aggregates of matter, and organic bodies to originate from pristine mud. Empedocles taught that the origin of things is due, not to transformation, but to the separation and combination of permanent elements. Leucippus and Democritus taught a doctrine of atoms, while Critias was the first who perceived the truth of the historical and social development of man. Aristotle showed a leaning to a natural interpretation of phenomena, while the Epicureans and Lucretius took a still further step in the right direction. Lucretius especially, with the foresight of the poet, anticipated, although from no sound basis, yet in a marked degree, the modern doctrines of the genesis of worlds and life forms, of the struggle for existence, and of the growth of language. To Descartes we owe something of the conception of nature as an orderly evolution, as well as much of the impulse in thought that has resulted in the developments of modern science. But, after the development of Physics, Chemistry, Geology, and the cognate sciences, it became only a question of who would be first to solve the problem that was being so grandly unfolded. The solution was wholly and completely Darwin's. Thus by slow degrees has been matured, though it is even yet in the infancy of its application to problems still untouched, that doctrine of evolution which covers the whole realm of science, from the process of the suns to the study of articulate speech. It is due to a naturalists' club, and is my intention this evening, to devote myself specially to the consideration of the evolution of organic beings.

There is some confusion in the popular mind as to the meaning of Organic Evolution. To a scientific society it is needless to explain that evolution does not mean that an ass may turn into an elephant, or that the frolicsome monkey is the ancestor of the sage president of some learned society. No greater mistake could be made than to suppose that descent has taken place in a linear series. What organic evolution really means will, perhaps, be made clear by an illustration. Suppose that a flood had covered the countless branches of some gigantic tree up to the topmost twigs. An inhabitant of the moon, to whom a tree would presumably be a new object, skimming the surface of the waters, would hardly suspect the vital connection between the twigs peeping above them. Each would be for him a little independent wooden island. But if the flood gradually subsided, he would see, to his amazement, the twigs unite to form small branches, these again to form other branches, terminal twigs reappearing which had been quite covered and lost in the flood, until at last he would discover that this multifarious arrangement of spreading growth sprang from a common bole.

Substitute for the terminal and unflooded twigs existing species, time for the flood, and extinct species for the branches that were totally submerged, and you will have no obscure conception of what is meant by descent. All forms of animal and vegetable life have sprung from one or a few simple sources, becoming more and more complex and differentiated from each other in the vast lapse of time, most forms becoming extinct, until the few that survive are so widely separated, and so diverse in structure and function, that their common origin has ceased to be discernible, and their connecting links are buried in the past.

But Organic Evolution is one thing, and the doctrine of Natural Selection is another.

Natural Selection is a theory as to the nature of one, perhaps of that one which is chiefest, of the factors which have produced the variation and development of species. Charles Darwin, by twenty years of patient labour, succeeded in demonstrating much of the manner in which the evolution of living forms takes place.

All animal and vegetable organisms tend to vary from one another. When the forces of nutrition are superabundant they would appear to be irregularly disposed and stored in the economy during that period of growth when the income of the organism is greater than its expenditure, and to become available for the production of new modifications. The modifications chiefly, though not exclusively, arise when the ancestral form having been, in the main, assumed, there remains a superabundant vitality—a balance at the bank, as it were—efficient to their production. Such variations tend to be transmitted from parent to offspring.

It is by some knowledge of these facts that breeders, florists and gardeners, produce their wonderful results. It is by practical though half-unconscious application of them, that the short-necked stumpy horse of primitive times has been converted into the swift winner of the Derby; that crabs have been turned into ribston-pippins; grasses into wheat and rice; and the inconspicuous dog-rose into the queen of flowers.

Now Darwin pointed out that what man does, nature also does, on an infinitely grander and more important scale.

Throughout nature more offspring is produced than can possibly survive. The chestnut-tree with its thousand spikes of many seed-bearing flowers; the fish that spawns so many thousand ova; the savage who is the parent of many children fated to an early grave, bear witness to the eternal tale of overpopulation. One crust will not feed many mouths. In the great battle for life which ensues, the best fitted to survive live on. Any little peculiarity which is an advantage to its possessor tells for him in that fierce strife, any disadvantageous modification tells against him. The best are triumphant, the weakest die. All beings that live are the selected aristocracy of the past. Whatever change of form or function adapts an animal or a plant to its environment bears it safely through the struggle for existence; and the beings so "selected" by nature, transmit, by the law of heredity, their fortunate peculiarities to their offspring, so that, in time, an improved generation effaces the old stock-form. Every little beneficial variation is seized upon by nature as eagerly as by the breeder. The flower of the flock alone survives. And when variations have taken place in different directions to such an extent as to produce quite different animals and plants, they are known to naturalists as kingdoms, sub-kingdoms, classes, orders, and species. When an organism is adjusted to its environment, the type remains fixed. But the external factors are ever changing; emigration and immigration of other tribes occur; the heavenly bodies exercise a varying influence on our planet; geological changes take place with slow and irresistible force,

"The hills are shadows, and they flow
From form to form, and nothing stands;
They melt like mists the solid lands,
Like clouds they shape themselves and go."

External nature changes, and with the changed conditions of life new adaptations must be added to and take the place of the old. In this eternal flux of things, whatever is useful persists; whatever is harmful is destroyed; and so calmly, slowly, nature treads her regal march along the road of development.

To the full, clear, unanswerable demonstration that evolution is, as well as to the elucidation of natural selection as a most potent factor in evolution, we are indebted to Charles Darwin. Whereas formerly we saw through a glass darkly, we now see clearly face to face—

> "Eye to eye we look
> On knowledge—in our hand
> Is nature, like an open book."

What is our evidence? There are many lines of argument leading to one conclusion, and which I shall venture, if your patience will permit, to consider with you *seriatim*.

Let us first take the *argument from the development of the individual, or Embryology*. Von Baer was the first to point out that, in the vital series, differentiation takes place from the general to the special. What is true of any series, historically and structurally considered, is also true of the development of any individual of that series.

We will at once take the crucial test—man himself—and I will ask you, when you have heard the evidence, to decide whether, if the individual man rapidly passes in his development through a series of changes leading from the simplest to the most complex form of life, and these changes are crowded into so inconsiderable a space of time, we need be very surprised to learn that the race has attained its high organization in the æons of geological time. A human being, as well as all animal and vegetable forms, first appears as a simple protoplasmic cell—a speck of albuminous jelly, like a protococcus, or a torula, or any other of the lowliest forms of vegetable life. This cell then undergoes yelk segmentation and develops into two layers of cells, while it also becomes grooved, so as to resemble a hydra—one of the jelly-fish tribe, which is also depressed and is differentiated into a double layer of cells: next the free ends of the groove unite and enclose an alimentary canal; the essential structure of the organism at this period being decidedly and strictly comparable to very low forms indeed of animal life. Meanwhile another depression appears on the opposite side to the first, the edges of which unite, while in their cavity the central nervous system is developed. The embryo now resembles the amphioxus of the sea-shore. A vertebral column now appears between the two great body cavities; but to determine whether the organism will become a perch, a crow, a dog, or a man, would not at this stage be a matter of extreme simplicity.

Later on the fœtus takes a mammalian form, with a highly respectable tail, and later still the purely human characters. What is true of the general form is also true of particular organs. The heart, for example, is at first a simple muscular tube, and then takes on fishlike, and later, reptilian characters, before it becomes completely mammalian in structure. At an early period of development man has gill-slits like a fish, and occasionally an unfortunate child is born with an unclosed gill-slit. What is true of man is true of the entire organic world. All the higher animals and plants pass through the same changes in their development as are represented by the permanent adult conditions of lower forms, still living or extinct. Characters unessential to subsequent development, but formerly of importance to ancestral forms, tend to appear earlier in development, to become shortened in their operation, and eventually to disappear. But salient points of the development of the species are always more or less represented in the development of the individual.

A striking example of the correspondence of certain stages of individual development with previous adult forms is supplied by the stag. Macaulay's schoolboy knows that the stag has only one point to his antlers the first year; the next year he has two points, the next three, so that you can tell the age of a stag by the number of his points. Now, in the middle miocene the fossil stag is found with two-pointed antlers, in the upper miocene with three points, acquiring more in the lapse of geological time, until we find him full antlered in the upper pliocene.

Let us now take the evidence afforded by *rudimentary structures*. And if any one is disposed to regard with suspicion the evidence of the comparative morphology of creatures other than man in its bearing on man, I will appeal from Cæsar unto Cæsar: I will discuss the point from the structure of man himself. I have already had occasion to mention that we have all of us rejoiced, happily before birth, in a conspicuous caudal appendage. And any one acquainted with the human skeleton will not fail to recognise in the coccygeal bones a very palpable rudimentary tail—a dwarfed and unnecessary member.

In the external ear of man we have remarkable evidence of dwindled rudimentary organs, representing structures of the highest functional value in allied mammalia. Not merely does the apex possess a fold, the secret of which is revealed when we find it developed in idiots into the pointed extremity of the ear of a lower animal, but there are distinct though rudimentary muscles for the purpose of drawing back, pulling forward, laying flat and otherwise waggling the ears for the collection of the waves of sound. I have known a professor of no small renown who, in addition to his other remarkable intellectual qualities, possessed the power of literally and intelligently pricking his ears at will. But this accomplishment, though amiable and attentive, has, unfortunately, become comparatively rare. Nevertheless the needful muscles for its performance, though unusable, exist in us all. What, on grounds other than those of descent, is the meaning of these rudimentary organs? Throughout nature it is most common to meet with dwarfed organs, that subserve no practical purpose to their possessor. Why, otherwise than by the theory of evolution, should the cub of the lion be striped? How is it that the fœtal whale possesses teeth which are absorbed and disappear before birth? How is it that among existing snakes the python alone possesses a single tiny pair of useless rudimentary limbs? Why have certain beetles abortive and unnecessary wings? Why does the calf possess certain teeth which never cut the gum? These questions are all solved by the reply that organs useful to their ancestors become rudimentary, and tend to disappear in such descendants as, living under changed conditions of life, no longer require them.

In all ages successful prophecy has been regarded as a pretty good evidence of truth, and Professor Huxley has proved himself to be a prophet of no mean order. Most vertebrates have five toes, and regarding the splint bones of the horse as rudimentary toes (an assumption which had been verified by the discovery of a fossil three-toed horse), Huxley predicted the discovery of a five-toed predecessor. This missing link has been found by Marsh of America. We have now a series of fossil horses, discovered in strata of different ages. In the older strata the five-toed ancestors of the horse are found (or, strictly speaking, four-toed horses with a rudimentary fifth toe); and from subsequent strata there have been exhumed successive modifications of this primitive horse, leading up to the single-toed horse of to-day. Anchitherium leads along the genealogical-tree, through Eohippus, Pliohippus, Protohippus, Miohippus, and Mesohippus to the hippus of to-day.

If not to a conception of grand, orderly evolution, to what do facts such as these tend? If from all our premises we accept not this conclusion, then by all logic are we bound to regard the universe as a kind of whimsical sorcery, a sad and pointless joke.

For my third series of evidences I will select the *argument based on Structure.* Among those creatures which are known as fishes to the popular mind, whales, porpoises, seals, sea-lions, and some others, are structurally as different from the ordinary population of the deep as dogs and cats are from pike and roach.

The gradual change of life from terrestrial to aquatic habits necessitated, it is true, correspondingly great changes of structure in these creatures. The bones became altered in shape, the more modifiable organs—the skin, the hair, the teeth—underwent great changes. The limbs became shortened or disappeared. The most useful form, the fish form, allowing swift progress through the water, was, by the process of natural selection, assumed. But these animals still breathe air and suckle their young; and no naturalist now classifies the cetacea and sirenia with fishes. On the evidence of structure alone, they are mammalia. No naturalist can admit a shadow of doubt on the point, any more than he would dream of associating bats with birds because they both fly, or crocodiles and rhinoceroses together, and these with beetles, because they are all protected by a horny case.

Take, again, the fore-limb of vertebrata. It consists of a single arm-bone, the humerus; two fore-arm bones, the radius and ulna; several wrist-bones forming a carpus, and a variable number of digits, usually five in the higher series. Yet this appendage, while retaining this essential structure, is so modified as to subserve me in writing this address, the monkey in climbing trees, quadrupeds in locomotion; it supports the wing of the bat, and enables it to fly; the fin of the porpoise, and enables it to swim. The human arm and leg, again, which are differentiated to fulfil such different purposes, are nevertheless homologues in structure and correspond to one another, bone to bone. In the words of Huxley, "Large groups of species of widely different habits present the same fundamental plan of structure; and parts of the same animal or plant, the functions of which are very different, likewise exhibit modifications of a common plan."

Fourth. *The Evidence of Mimicry.*—Not infrequently organisms are met with in the animal and vegetable kingdoms which closely simulate the appearance, and sometimes the habits, of other organisms.

The chameleon, it is well known, by certain changes in the pigment-cells of the skin, has the power of assimilating its colour to that of its surroundings, which is a clear advantage to any animal that, for any reason, may desire to lie perdu. The stripes of the tiger simulate the coarse colouring of tropical grass; the skin of the lion is tawny—the colour of his habitat, the desert sand. In some degree mimicry is the reason why a keen eye discovers so little evidence of life in the open, which we know is full of life. There are butterflies which closely resemble leaves and bits of stick. One has to look intently to distinguish the larger snakes from the branches round which they wind themselves, as one may see any day at the Zoological Gardens; where also there is a green toad, not easily discoverable amid the foliage of his abode. Hen-birds that sit in open nests are dull and unattractive of hue. Spiders associating with ants become antlike in form and colour. Bates, in his travels, speaks of having been considerably frightened by a species of huge caterpillar, which had assumed the appearance of a poisonous snake. The only explanation sufficient to account for these facts is, that any little modification tending to make one species more like another, where such likeness is an advantage either for protection or attack, will tend to be preserved; and gradually such favouring peculiarities of resemblance will become closer and more numerous. Thus the fact of mimicry is not merely explained by the theory of natural selection, but affords an important argument in support of that theory.

Fifth. *Classification.*—All naturalists have tried to arrange living creatures according to their essential and structural affinities. "Community of descent," says Darwin, "was the hidden bond which they had been unconsciously seeking." Now, of forms still living, the various kinds often approach each other so nearly, and at so many different points, that no two naturalists will precisely agree as to a system of classification. To take a glaring instance. The differences between animals and plants would appear to be sufficiently characteristic. There is no difficulty in distinguishing organisms so dissimilar as Oscar Wilde and his lily. But, in the lower series, the animal and vegetal characters are so indeterminate, that it is frequently difficult, and sometimes impossible, to say whether a lowly organism should be classed with animals or plants—a fact which led Hæckel to propose a new kingdom for such forms, that of the Protista.

Whatever gaps there are in the organic series are constantly being filled up by discoveries of living or extinct animals and the essential nature of their structure. Nor is this all. Why should the higher animals have seven cervical vertebræ and no more, except by reason of descent? Why should all vertebrates have not more than two pairs of limbs —so that the monkey is obliged to develop the resources of his tail? I know of no sufficient answer but that given by Darwin. It is difficult, on any other assumption, to understand either the remarkable ease with which certain animals and plants fall into their natural orders, or the remarkable difficulty in separating certain other orders, or the impossibility of agreement as to the species of certain large genera.

Is there any other explanation that will account for the fact that the young batrachian has gills like a fish; that the wingless dodo was nevertheless structurally a bird; that the ornithorhynchus and the echidna, though essentially mammalia, approximate to the bird type; that any natural classification is possible at all?

What would you think of a modern scholar who should doubt the common origin of the Indo-European family of languages and deride Grimm's law. More than Grimm did for philology has Darwin done for natural history. Just as certainly as the similarities of the Aryan tongue point to a common Aryan origin, so surely do the similarities of animals and plants point to a common descent. And as the bonds of connection between tongues are to be found not merely in living languages, but in fossil forms of speech—in Greek, in Latin, in Sanskrit—so every year supplies us with fresh links that are missing in the series of organic life by the discovery of new fossil forms.

This brings us to our *Sixth great argument, the Geological.* I have more than once referred to geological facts in the consideration of other aspects of the question before us, and I will now state, as concisely as may be, certain geological facts which bear very directly on Darwinism. Fossils from the later tertiary periods are closely allied to their living representatives of the same area. For example, the fossil marsupials from Australian caves are strikingly like the living marsupials. In South America there is "a wonderful relationship between the dead and the living." Similar relationships hold between extinct and extant land-shells of Madeira and water-shells of the Caspian Sea.

Further, extinct and even living types have often affinities with very different kinds of animals. Of living animals, the lepidosiren associates in itself many characteristics of different kinds of fishes. How much more is this the case among fossil forms, where, as in the archeopteryx and campsognathus, the hiatus between bird and reptile is bridged over, so that naturalists are now obliged to classify birds and reptiles together as sauropsida.

"The zeuglodon and squalodon," again, says Huxley, "constitute connecting links" between other mammals and "the aquatic carnivora." Not merely are the affinities of extinct with living species remarkable, but their mutual affinities are equally striking, inexplicable indeed except on the theory of descent. Again, we find in the geological record that the forms of life change simultaneously all over the world, which can only be explained by the wide and speedy spreading of successful and selected modifications. Again, species once lost do not reappear: this is of itself a fact full of significance, but is of vast importance when considered in relation to the gradual elaboration of structural organization, as revealed by the geologist's hammer. The lower the rock, the lower and simpler is the species. With every succeeding stratum, the volume of evidence is increased by the presence of intermediate links which bridge the wider differences between living forms. From the simple to the complex is the law of palæontology no less than of embryology. It is indeed astounding that a record so necessarily imperfect as that of a few rocks still existing out of many that have been denuded and lost, bearing a few accidental remains, and only very partially explored, should nevertheless testify so strongly to the truth of organic evolution.

The Evidence from Geographical Distribution.—The distribution of animals and plants cannot be accounted for by differences of climate. The old and new worlds offer a thousand parallels of climate, but how dissimilar are their flora and fauna! You will remember that I drew your attention to the correspondence between extinct and existing forms in the same geological area. Now, not only the living species, but also the fossils of one area are different from those of another, where there has been or is a barrier to their free migration. The species which inhabit opposite sides of lofty mountain chains, or of great rivers or of deserts, differ remarkably; and this is much more the case with the inhabitants of widely-separated continents. The marine flora and fauna of sea-shores separated by deep and extensive seas differ in an equally marked manner; while continents, such as Europe, possessing few barriers to free migration, have a striking community of living productions. The case is still more suggestive when we consider the life-forms of oceanic islands. The more isolated the island the fewer is the number of species to be found on it, the greater is the absence of animals and plants, now represented on neighbouring continents, and especially of such animals and plants as are incapable of migration; and the more remarkable is the similarity between the extant and extinct organisms of such islands.

Moreover, the genera of an oceanic island are often peculiar to it, and the nearest allies of such living genera are often to be found in the fossil remains of the nearest continent. Where there is a great number of other islands, between an oceanic island and the mainland, which may serve as halting-places, the differences between the organic life of the remote island and of the continent are less marked than they are in the solitary islands of a great ocean. This is exactly what one would expect to find, for the essential relative positions of the great continents and the great deep seas have, amid minor changes, probably remained fairly constant throughout geological times. Consequently the only colonists of oceanic islands would be such animals and plants as might be floated by trees, or carried by winds, or endowed with sufficient vitality to resist the injurious influence of sea-water while conveyed in the strong currents of the ocean.

No other hypothesis than that of a common descent will account for the facts of the geographical distribution of living forms, while that hypothesis is perfectly sufficient to explain these facts, even when they are apparently most incongruous.

The Argument from artificial Selection or Breeding.—What nature does on her stupendous scale man also effects in a minor degree; and in this, as in so many other branches of science, the adaptations of man suggest an explanation of the methods of nature. Consider how, by carefully selecting trifling modifications, and breeding from these modified forms, man has been enabled to produce and preserve stocks so different as the dray horse, the Shetland pony, the hack and the race horse; dogs so diverse as the otter hound and the grey hound, the lordly mastiff and the æsthetic pug.

To this process are due the varieties of cattle; the innumerable kinds of roses, of pelargoniums, of fuchsias; the vastly differing qualities of apples and of wall-fruits. Men themselves, even those of the same nation, are, by the more or less artificial selection of our social organization, born adapted to their future avocations—the idler with the bearing of his class, and the son of toil with shoulders equal to his burden.

It is found that the more the varieties of a species are differentiated from each other, the less prolific are they in crossing. Could anything be more suggestive of the truth of our thesis?

The Imperfection of Structures affords another argument on which I will not dwell, further than to state that it is not uncommon to find structures which fulfil their functions usefully to their possessor it is true, but very imperfectly from an ideal standpoint. Whatever imperfection we might find in actual structure, we should not, if species were separately and specially created, expect to find a defect in the plan of their organization. But every oculist regards that marvellous mechanism, the human eye, as no ideally perfect structure, incapable of improvement, but as decidedly capable of an improved reconstruction on optical principles. This and other similar facts become comprehensible by the theory we are considering.

Moreover, throughout nature there are few instances of the adaptation of one species of animal or plant to the advantage of another species of animal or plant. Of direct and exclusive adaptation, there is absolutely no evidence whatever. That they afford food for one another would appear to be a doubtful benefit to the organism that happens to be eaten; and often the higher life affords an agreeable dietary to the lower. The law of nature is

> "The good old rule, the simple plan,
> That they should take who have the power,
> And they should keep who can."

This fact, in perfect harmony with natural selection and development, is certainly not in keeping with any theory of special and separate creation of living forms.

And, as a final argument, I would ask, if species did not arise by evolution, what is their origin? As Mr. Herbert Spencer has pertinently inquired, if not by evolution, how? Did they wriggle up from the ground; or fall from the skies; or did their parts assemble together, borne by the four winds; or were they separately created in order to demonstrate the foolishness of philosophers and the delusiveness of logical proof?

And now our time is getting so short that I must reluctantly bring my remarks to a close. But before doing so, I should like to point out that it is no small confirmation of a theory if, besides illuminating one fact, it also explains many. Newton's theory is proved doubly true when it explains the mechanism of the heavens as well as the fall of an apple. Now I care not what branch of study you may take—mental or moral science, or history, or practical politics—and you shall find the strong electric light of evolution making the dark way plain and the intricate paths clear. He was no fool who said in that parliament of mixed races, the Reichstag of Vienna, "The first thing we have to do is to ask ourselves, 'Is Darwinism true?'" I would that I had time, or that it came within the limits of a Natural History Society, to show how the application of what we know of evolution removes many of those difficulties which encumber the explanation of the origin, scientific basis, and true reason for right-doing; how it demonstrates the essential nature and reasonableness of morals in their widest and highest sense. I can do no more than allude to the further problem of the first appearance of life on our globe. I may, however, state that the theory of a vital force is finally abandoned by the physiologist, and that the recent production of organic compounds in the laboratory and the indisputable evidence that organic operations are purely mechanical, physical, or chemical in nature, have paved the way to an understanding of the genesis of protoplasm. I think I have, at all events, by many lines of converging evidence, proved the truth of a proposition which no man of healthy intellect and unbiassed judgment can well attempt to controvert. If he does, he violates that logical law of parsimony which accepts the simplest as the truest explanation, and by reason of which thinkers of the past abandoned Kepler's theory, that each planet had its guiding angel, when Newton had explained their complex motions by the simple theory of gravitation.

I am not of those who take a purely optimistic view of the process of evolution. I cannot blind myself to the vast amount of misery and pain that is implied in the survival of the fittest. But when I reflect that man alone appears to be endowed with a very high sensibility to suffering, and that the development of human sympathy and science and social organization can do much to alleviate the misfortunes of those that are worsted in the great battle of life; when I review the history of life, and find it to be altogether a history of progress; I am content to submit myself, without murmuring, to the great law of evolution. I am of opinion that a clear perception of the nature of that Unfailing Order of which we are the children may do much to mitigate the horrors of its operation; and that the human mind will proceed to greater triumphs and a calmer happiness when enlightened and enriched by the wisdom that grows from natural knowledge.

THIRD

ANNUAL REPORT OF THE COMMITTEE.

SESSION 1882-83.

At the close of this, the third session, your committee have great pleasure in stating that the Club is in a satisfactory condition, and has made considerable progress during the past year.

At the commencement of the session the members numbered thirty-six. During the year twenty-one new members have been elected and seven have resigned, showing an increase of fourteen since the last report.

The ordinary meetings have been well attended, and the exhibition of objects of interest at these meetings has tended to increase their attractiveness. Members are invited to exhibit Natural History specimens at these monthly gatherings.

The following papers were read:—

1882. April. . . "The Common Frog," by Mr. C. A. Watkins.
„ May. . . "The Antiquity of Man," by Mr. F. W. Rudler, F.G.S.
„ June. . . "The Study of Natural History," by Mr. G. Douglas Pidcock, B.A., M.B.
„ July. . . "A Century of Natural History," by Mr. A. H. Singleton, F.R.Hist.S.
„ October. . "The Oldest British Rocks," by Dr. H. Hicks, F.G.S.
„ November. "Volcanic Action," by Mr. C. H. Watkins.
„ December. "The Geological Evidences of the Antiquity of the Globe," by Mr. Manuel M. Terrero, A.R.S.M.
1883. January. . "Certain Points in the Study of the Mammalia," by Mr. E. H. Scott, M.R.C.V.S.
„ February. "Ferns and their History," by Mr. T. R. Keys.
„ March. . "The Human Ear," by Mr. Bevil Granville.

The thanks of the Club are due to Dr. Hicks for his kindness in lecturing on the occasion of the October meeting, and also to Mr. M. M. Terrero for the paper which he read in December.

The treasurer's balance-sheet shows that the expenses of the Club have been within the income, and that there is a small balance to carry forward.

Your committee regret that the excursions have not been well attended, and hope that in future the members will avail themselves of these outings more frequently, as they are not only most pleasant social gatherings, but offer an agreeable means of obtaining and imparting information.

The following excursions were made during the year:—

1882.	April 15. . .	To Kew Gardens.
"	May 6. . .	To Watford.
"	" 13. . .	To Boxhill.
"	July 1. . .	To Redhill, Godstone, and Caterham.
"	" 22. . .	To Leith Hill and Dorking.
"	November 25.	To the British Museum, Botanical Department, when Mr. J. Britten, F.L.S., gave a demonstration.

Your thanks are due to Mr. J. Hopkinson, F.L.S., F.G.S., for his kind assistance on the occasion of the Watford excursion.

The Club's collection in the Museum has steadily increased both in number and importance since the last report was issued, and the room is now barely large enough to accommodate the numerous specimens.

The books on Natural History in the Museum have not been so freely used as could be desired.

In consideration of the want of accommodation for the specimens in the Museum and the desirability of arranging them in a more central position in the town, your committee have been considering ways and means for accomplishing this and obtaining a room sufficiently large for displaying the collection and holding the monthly meetings.

The present income of the Club being inadequate to meet this extra expense, several gentlemen have offered to subscribe one guinea each per annum towards a Rent Guarantee Fund, and your committee will be pleased if others will follow this good example and send in their names to the secretary.

As soon as a sufficient fund is established, your committee will endeavour to secure a suitable room and arrange other necessary matters connected with such business.

Your thanks are again due to Mrs. Ellis for her liberality in allowing the Club the free use of a room for the Museum.

Your thanks are also due to the following gentlemen who retire: Mr. Henry Ellis, Vice-President; Mr. Louis Blumfeld and Mr. J. S. Ellis, on the committee.

Owing to other engagements, Mr. F. L. Watkins has been compelled to resign the secretaryship. Your committee propose Mr. C. H. Watkins, who has acted as treasurer for the last two years, to fill the office of secretary, and trust the list of officers and members of committee for the ensuing session will meet with your approval.

Before closing this report, your committee think that mention should be made of the energetic way in which our president has worked for the benefit and welfare of the Club, the large increase in the number of members being mainly due to his exertions.

In conclusion, your committee would impress upon members the necessity of co-operating with them in order to extend the advantages of the Club by drawing their friends' attention to it and inducing them to become members.

As there is no kindred institution in Hampstead our progress should continue, but it rests chiefly with the members to ensure the advance of our Club to a prominent position.

Hampstead Naturalists' Club.

BALANCE-SHEET FOR THE YEAR ENDING MARCH 14, 1883.

Receipts.	£	s.	d.	Payments.	£	s.	d.
Balance from last Account	0	7	3	Museum	9	6	6½
Subscriptions	20	3	0	Stationery	0	16	9
Donations	0	15	0	Postage	1	16	6½
Sale of Botanical Paper	0	5	0	Printing	4	3	0
				Library	0	4	0
				Sundries	0	7	6½
				Gas and attendance	1	10	0
				Advertisements	1	8	4
				Balance in hand	1	17	6½
	£21	10	3		£21	10	3

We have this day examined the Treasurer's accounts and found them correct.

FREDERIC G. HOWARD,
G. DOUGLAS PIDCOCK, } *Auditors.*

March 14, 1883.

REPORT OF THE CURATOR.

I AM pleased to be able to report that the Museum of the Club at the end of this third session is in a very prosperous condition. I anticipate that before the close of next session we shall no longer be in our present quarters, for we are fast outgrowing them. With a central Museum, the growth of the Club would be still more ensured and its sphere of usefulness enlarged. The present collection is contained in about fifty cases, to which we are constantly making additions. It comprises every branch of Natural History, and I believe no large class is unrepresented, except perhaps the Fungi and Mosses.

The Zoological collection is naturally the most numerous one, and contains about 2,415 specimens comprising 1,135 species. Of these, the collection of Lepidoptera is the largest, containing 813 specimens and 319 species. Next comes that of Shells, with 487 specimens of 206 species. The Coleoptera follow with 292 specimens of 113 species.

The Botanical collection comes next in importance, and contains about 559 specimens, but of only 284 species.

This number of specimens includes, however, a large collection of Seeds. The collection of wild Plants is now, I am pleased to report, in a much more statisfactory condition than it was at the close of the second session, and is now laid out in the same manner as the National collection at South Kensington. It contains 213 specimens of 182 species of British and Foreign Plants, and if the weather be favourable during the approaching summer I have no doubt we shall be able to double this number.

The Geological and Mineralogical collections, although least in numbers, together contain about 556 specimens, of which the fossil collection numbers 315 specimens, minerals 179.

The total number of specimens in the various collections particularised above amounts to 2,526. The number of different species (including as species well ascertained varieties) amounts to 1,761 in all. These numbers show an increase of about 1,000 specimens and 600 species on those of last year, and I think the members of the Club may justly congratulate themselves on the increase of the Club's collection.

In conclusion, I may say that, with the aid of my able assistant-curator, Mr. F. H. Haines, the arrangement of the various collections has been carried out according to the best authorities obtainable, and in the order most nearly approaching the natural system laid down by our greatest naturalists.

The Library contains fifty books on Natural History, but very few members avail themselves of their privileges in this direction, and I expect to see an increase of interest in this department result from the moving of the Museum to a more central position in the town.

ROLAND ELLIS,
Curator and Librarian.

March 31, 1883.

LIST OF MEMBERS.

Honorary Members.

S. A. Nottcut, 98, Anglesea Road, Ipswich.
John M. Campbell, Joint Secretary, Glasgow Natural History Society, Kelvin Grove Park, Glasgow.
G. S. Jealous, 1, Villas on the Heath, Hampstead, N.W.
John Morris, M.A., F.G.S., 15, Upper Gloucester Place, Dorset Square, N.W.

Ordinary Members.

Date of Election.	
Dec. 14, 1881	Barham, George Titus, Danehurst, Haverstock Hill, N.W.
April 19, 1882	Beeton, Henry Ramié, 42, Belsize Square, N.W.
July 4, 1880	Blumfeld, James L., Brauneck, Prince Arthur Road, Hampstead, N.W.
July 10, 1880	Blumfeld, Joseph, Brauneck, Prince Arthur Road, Hampstead, N.W.
Nov. 9, 1881	Blumfeld, Louis, Brauneck, Prince Arthur Road, Hampstead, N.W.
Nov. 9, 1881	Boulting, William, L.R.C.P. (*President*), 1, The Mount, Hampstead, N.W.
Nov. 13, 1880	Burgin, Charles, 15, Gray's Inn Square, W.C.
June 15, 1882	Carden, H. L., 1, The Lawn, Haverstock Hill, N.W.
June 15, 1882	Carden, W. V., 1, The Lawn, Haverstock Hill, N.W.
Jan. 10, 1883	Casson, Arthur, 2, The Mount, Hampstead, N.W.
Feb. 14, 1883	Claudet, Arthur C., A.R.S.M., 10, Oak Hill Park, Hampstead, N.W.
Nov. 9, 1881	Dawson, Hubert, The Mount, Hampstead, N.W.
Feb. 8, 1882	Dighton, E. A., 12, Park Road, Haverstock Hill, N.W.
July 4, 1880	Durham, A. Ellis, 82, Brook Street, Grosvenor Square, W.
July 4, 1880	Durham, Herbert, 82, Brook Street, Grosvenor Square, W.

Date of Election.	
July 4, 1880 .	. Ellis, Roland (*Curator*), The Avenue, North End, Hampstead, N.W.
Nov. 8, 1882 .	. Gordon, R. M., 50, South Hill Park, Hampstead, N.W.
Oct. 12, 1881	. Gordon, Thomas H., B.A., 9, The Crescent, Dukinfield, Cheshire.
Dec. 15, 1882	. Granville, O. B., Caroline House, The Mount, Hampstead, N.W.
Nov. 9, 1881 .	. Gundry, Joseph, 108, Haverstock Hill, N.W.
Sept. 25, 1880	. Haines, F. H., 184, Haverstock Hill, and Edenbridge.
Oct. 11, 1881	. Haines, Frederick, F.S.A., 184, Haverstock Hill, and Edenbridge, Kent.
Dec. 14, 1881	. Haines, Alfred, 3, Ashburton Villas, Atney Road, Putney, S.W.
June 11, 1881	. Hoskyn, D. T., 1, Birchington Road, Kilburn, N.W.
Feb. 12, 1881	. Howard, Frederic G., 107, Priory Road, West Hampstead, N.W.
Jan. 11, 1882	. Howard, Frank G., Oaklands, Cricklewood, N.W.
Mar. 14, 1883	. Hunt, Walter Leigh, Lyndhurst Road, Hampstead, N.W.
Feb. 8, 1882 .	. Jolly, H. F., Stowe Villa, Bath.
June 15, 1882	. Keys, T. R., 47, Heath Street, Hampstead, N.W.
Nov. 13, 1880	. Moir, Macrae, 2, Willoughby Road, Hampstead, N.W.
Nov. 8, 1882 .	. Phillips, J. W., Percy House, North End, Hampstead, N.W.
Feb. 8, 1882 .	. Pidcock, G. Douglas, M.B., B.A. (*Vice-President*), Winsborough House, Downshire Hill, Hampstead, N.W.
Oct. 12, 1881	. Rudler, F. W., F.G.S., 6, Regent's Park Villas, Gloucester Gate, N.W.
Nov. 8, 1882 .	. Scott, E. H., M.R.C.V.S., 6, Heath Street, Hampstead, N.W.
June 15, 1882	. Singleton, A. H., 4, Glebe Place, Chelsea, S.W.
June 11, 1881	. Stuart, C. E., B.Sc., 23, Clayton Park Road, Newcastle-on-Tyne.
Nov. 8, 1882 .	. Stuart, John Edward, Fairview, Arkwright Road, Hampstead, N.W.
Nov. 8, 1882 .	. Thompson, Wilfred, 27, Church Row, Hampstead.
July 10, 1880	. Watkins, A. L., Rosemont. Greenhill Road, Hampstead, N.W.
July 10, 1880	. Watkins, Charles A. (*Vice-President*), Rosemont, Greenhill Road, Hampstead, N.W.

Date of Election.	
July 4, 1880 .	. WATKINS, C. H. (*Hon. Secretary and Treasurer*), Rosemont, Greenhill Road, Hampstead, N.W.
July 4, 1880 .	. WATKINS, FRED. L., Rosemont, Greenhill Road, Hampstead, N.W.
Dec. 15, 1882	. WELTON, WILLIAM S., The Limes, North End, Hampstead, N.W.
Dec. 15, 1882	. WELTON, WILLIAM P., The Limes, North End, Hampstead, N.W.
Jan. 10, 1883	. WILLIAMS, W. D., High Street, Hampstead, N.W.
Oct. 11, 1882	. WITH, Rev. A., M.A., 6, Heath Rise, Hampstead, N.W.

Hampstead Naturalists' Club.

RULES.

1. That the Club be called the HAMPSTEAD NATURALISTS' CLUB.

2. That the objects of the Club be to facilitate the study of Natural History—

(*a*) By holding Meetings at which Papers on subjects of Natural History may be read and discussed.

(*b*) By making Excursions.

(*c*) By forming and maintaining a Museum and Library.

(*d*) By publishing Proceedings.

3. That application for Membership be made through the introduction of one or more Members of the Club, who shall sign a certificate in recommendation of such Candidate, stating his name and address, which shall be read by the Secretary at the Ordinary Meeting following the receipt of such Certificate. The election of Members shall be by Ballot, and take place at the ensuing Ordinary Meeting of not less than ten Members (one black ball in five to exclude).

4. That the Club consist of Ordinary and Honorary Members. All Members to have the right of introducing two friends to the Ordinary Meetings, Excursions, and Museum, and of receiving a copy of these Rules. Honorary Members shall not vote at elections.

5. That the election of Honorary Members take place at the Annual General Meeting of the Club through the recommendation of the Committee, but the number of Honorary Members shall not exceed twenty.

6. That the Annual Subscription be 10s. (payable to the Treasurer), and become due on the 1st day of April. The Subscriptions of Members elected after that month shall become due on the first quarter-day after election, when they shall pay a *pro rata* subscription for the current year.

7. That any Member whose Subscription is twelve months in arrear shall not be entitled to any of the privileges of the Club, and if he be two years in arrear he shall be excluded from the Club by the General Committee.

8. That the affairs of the Club be managed by a General Committee, consisting of a President, two Vice-presidents, a Hon. Secretary, Hon. Treasurer, Hon. Curator and Librarian, and five elected Members—five to form a quorum—who shall be elected annually, and be eligible for re-election.

9. That an Ordinary Meeting of the Club be held on the second Wednesday in each month, except August and September, at eight o'clock in the evening, or such other day and time as the Committee may deem fit, and that the Secretary give fourteen days' notice to every Member of the time, date, and business of each Meeting.

10. That the Annual General Meeting be held as early in April as the Committee can arrange, when the Officers for the ensuing year shall be elected, and the Balance-Sheet and the Report of the Committee read. Notice to be given as in Rule 9.

11. That at the request of the Committee, or on receipt of a requisition signed by any eight Members of the Club, the Secretary shall within ten days call a Special General Meeting at a convenient place in Hampstead stated on the requisition. The Secretary shall give the Members seven clear days' notice of such Meeting and the purpose for which it is called. Fifteen members to form a quorum.

12. That no alteration be made in the Rules of the Club except at the Annual General Meeting, and all proposals of alteration to be sent to the Secretary five weeks before the

Meeting, of which he shall give four weeks' notice to every Member.

13. That the Curator have charge of the Club Collection and Library, and keep a classified list of the specimens and books contained therein, which shall be open for the inspection of Members.

14. That the Treasurer keep an account of all moneys paid to and by him and balance the accounts half yearly.

15. That two Members of the Club be elected Auditors, who shall audit the accounts of the Treasurer and report on them at the Annual General Meeting.

16. That all donations to the Museum be sent to the Curator, and announced by the Secretary at the next Ordinary Meeting.

17. That no live specimen be received by the Club.

18. That all duplicate specimens be at the disposal of the Committee.

Transfd from Geol Dept.
5 MAY 886

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HAMPSTEAD NATURALISTS' CLUB

FOURTH

ANNUAL REPORT

PRESIDENTIAL ADDRESS

List of Members

RULES OF THE CLUB, ETC.

PROCEEDINGS [illegible]

NOTICE

[illegible] will benefit [illegible] reports [illegible] Copies can be [illegible] Hon. Secretary [illegible] Price [illegible]

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HAMPSTEAD NATURALISTS' CLUB

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PROCEEDINGS: APRIL, 1883, TO MARCH, 1884

BRITISH MUSEUM NATURAL HISTORY

HAMPSTEAD

APRIL, 1884

Price One Shilling.

HAMPSTEAD NATURALISTS' CLUB

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HAMPSTEAD

APRIL, 1884

Hampstead Naturalists' Club.

OFFICERS AND MEMBERS OF COMMITTEE

ELECTED APRIL 4th, 1884.

President.

CHARLES A. WATKINS.

Vice-Presidents.

G. DOUGLAS PIDCOCK, B.A., M.B.

F. W. RUDLER, F.G.S.

Hon. Secretary and Treasurer.

CHARLES H. WATKINS,

Rosemont, Greenhill Road, Hampstead, N.W.

General Committee.

W. BOULTING, L.R.C.P.
ROLAND ELLIS.
R. M. GORDON.
BEVIL GRANVILLE.
F. W. RUDLER, F.G.S.
H. COOPER, M.R.C.P.
G. D. PIDCOCK, B.A., M.B.
CHARLES A. WATKINS.
CHARLES H. WATKINS.
FREDERIC L. WATKINS.

Hon. Curator and Librarian.

ROLAND ELLIS.

Auditors.

LOUIS BLUMFELD.
THOMAS R. KEYS.

THE

CORRESPONDENCE OF BODY WITH MIND:

BEING

The Presidential Address

DELIVERED BEFORE THE HAMPSTEAD NATURALISTS' CLUB AT THE CLOSE OF THE SESSION 1883–84,

BY WILLIAM BOULTING, L.R.C.P.LOND.

A FEW generations ago psychology was a *terra incognita*, a sort of Central Africa of science, the haunt of mysticism and metaphysics. A few bold explorers had, it is true, invaded its territories, with little success. Within the last few years, however, the researches of physiologists and physicians have added much to our knowledge of mind and of its organ—the nervous system.

Now, happily, we can at least map out the territories and are acquainted with the main features of this much disputed region. It is my purpose this evening to give you a brief survey of such of the relations of the mind to the nervous system as are already ascertained or may be legitimately inferred to exist.

The study of mind naturally divides itself into three great branches of inquiry.

1st. The examination of one's own mind, or *subjective psychology*.

2nd. The observation of the minds of other men and animals, or *objective psychology*.

3rd. The study of the structure and function of the brain and nervous system, and the relation that physical bear to mental facts, or *neurology*.

I propose to devote the time at my disposal chiefly to a rapid sketch of the functions of the nervous system, in so far as they may throw some light on the problems of mind; though I shall also of necessity make frequent use of some of the facts of psychology. What I shall endeavour to show is that we have good ground for inferring that mental operations are invariably accompanied by physical changes; that these changes occur in an unbroken order; and that side by side with their increasing complexity and development we find an increasing complexity and development of mental phenomena. I shall conclude by a discussion as to what may be inferred as to matter and what may legimately be included in the term mind.

You have probably all seen such simple forms of life-stuff as the amœbæ. An amœba is a speck of that semi-fluid, jelly-like substance which is the physical basis of all life, and by the changes of which all the organisation and functions of living beings become possible. The simpler forms of this protoplasm are unstable, responding to stimulus. They become lively in their movements on the application of heat. They either seek or avoid the light. Different parts become protruded and retracted; small objects are included in the moving body, are passed through it, and if nutrient are digested; but there is no visible differentiation of parts, there are no organs. The entire functions of life—digestion, reproduction, locomotion, and, extraordinary as it may seem, response to such stimuli as touch, light, and heat—are performed, not by any one part of the organism, but by its life-stuff as a whole. So that a quasi-nervous response to stimulus is inherent in the simplest form of living matter.

Higher up in the animal series we find that the protoplasm of the organism where it is most subject to irritating influences undergoes a structural change which transmutes it into muscular tissue. Still higher up in the scale of progressive organisation we find that external shocks or stimuli are liable to happen more at one part of the organism than at another; and that these shocks get to be transmitted in definite directions. They make paths, as it were, for themselves, and as the stimuli are frequently repeated we get certain directions of the organic protoplasm so constantly traversed by these impulses that they become, so to speak, well-beaten roads; in other words, the protoplasm is reconstructed by successive shocks into nerve-tissue. The nerve-track is found to enter a cell of very mobile protoplasm, and then it does not traverse the organism, but usually bends on itself and ends in a muscle. This is the key to nervous organisation. From so simple an arrangement is it that the most complex of systems, the nervous system—brain, and cord, and nerves—is built up. Everywhere we can reduce the most complicated arrangement to its simplest expression—ingoing nerve-track, mobile nerve-cell, and outgoing nerve-track usually ending in a muscle.

In the jelly-fish we find ingoing nerves which end in cells whence issue outgoing nerves. But the cells are collected together into nerve-centres, and each nerve-centre is brought into relation with many ingoing as well as outgoing nerves, and not merely so, but also, by means of connecting nerves, with other centres. A stimulus is thus capable of being conveyed throughout the organism. But if you cut the animal so as to isolate a nerve-centre, with its ingoing and outgoing nerves, the part so isolated will respond to stimuli, but the effect of the stimulus is localised to that part. It is no longer felt or responded to by the organism as a whole. This is a so-called reflex action in its simplest expression. So that the association of nerve-centres effects a co-ordination of movement, implies an analogous associated response of the entire organism.

In the higher forms of jelly-fish we get a definite response to stimulation according to the seat of its application. If you prick a polypite it moves over towards the needle. The movements are co-ordinated so as to make appropriate responses to definite stimulations. But directly you sever the connections of the nerve-centres, a stimulus is only responded to by that part of the animal in which the nerve-centres still remain intact. It is easy to understand how the proximity and association of nerve-centres facilitates the adjustment of the response to the stimulus. It favours the transmission of messages along an increasing complexity of nerve-routes. Particular stimuli produce a response at a distance, having traversed particular nerve-paths. Each advance forms a base of operations for future advances. Just as in learning to walk each adjustment of the body makes the next step easier; or, as in learning a language, each acquirement makes progress possible, each simple sentence helping the learner to construct sentences more complex, so does each association and differentiation in nerve-routes make acquirement and development possible.

I said that the fundamental plan of nerve-organisation is exceedingly simple. The ideal plan, which is that simple form to be found in lowly organisms, is as follows. An ingoing nerve consisting of nerve-filaments conveys the sense-impression, and hence is called a sensory nerve. It ends in cells collected together and called the sensory centre. These are connected by nerve-filaments with another group of cells called a motor centre, and from this centre the outgoing impression is conveyed along a motor nerve. The motor and sensory centres are usually, however, associated together, and are also connected with other motor and sensory centres. Consequently an impression is conveyed along the sensory nerve to a nerve centre which is a point of meeting, or a junction-station as it were, where it is brought into relation with other impressions, shunted on to another line it may be, combined with other impressions or separated into its various components, until it eventually makes its exit in some way or other along a motor track.

Just as efficient railway communication depends on the development of junctions, so all advance depends on the progressive association and complexity of nerve-centres.

Thus, the caterpillar has many pairs of nerve-centres, each pair corresponding to a segment of the body. But when it becomes a highly organised insect, the nerve-centres collect together to form fewer but more complex ganglia. Similarly in the ascending series of the crab and lobster tribe, we find an increasing coalescence of ganglia or nerve-centres. The higher and more complex the functions, the more intimately associated and complex are the ganglia.

The development in the animal series of complex co-ordinated movement as well as of intelligence, depends on the development of the organs of sense. The principal collection of ganglia, called the brain, is usually in the head of the animal; and its development is directly proportional to the development of the organs of sense. I shall endeavour to show why the sense-organs are situated near one another, and hence why their associated ganglia—the brain—is located in the head.

By the repeated stimulation of contact with food, the reason is evident why the sense of *touch* should be developed, at all events at first, in the neighbourhood of the mouth. Hence the appearance of the tactile papillæ and tentacles surrounding the mouth in lower organisms. The repeated stimulation of a part, in other words the function of that part, induces structural changes. Protoplasm being unstable, differentiates along the roads traversed by repeated stimuli.

Taste also is developed in the same region by the contact of soluble matter. It is a forecast of digestion, and becomes associated with other organs by means of the nervous mechanism I have described, so that the stimulus of taste issues in the reflex actions of the flow of gastric juice and of swallowing.

Just as taste is anticipatory to digestion, so the sense of *smell* is developed as anticipatory to taste. It is clear that an organism that can so foretaste its prey at a distance will derive a keen advantage in the struggle for existence.

Sight.—In the oyster we find certain dark-coloured cells which form a rudimentary eye. When an impression falls on this pigmented spot the oyster closes its shell. It is a long step from this simple eye to the eye of the hawk. This bird can discern field-mice and select its victim while hovering out of human sight. Likewise the rudimentary response in the closure of the oyster-shell is incommensurable with the delicate and swift motion of the bird's wings. There is a long series of developmental changes between the simple ganglion of the oyster and the sight-centres of the bird and their associated centres for the complex muscular movements of its flight. Just as we saw smell to be an anticipatory taste, so we may regard sight as an anticipatory touch, leading to muscular movement.

We can easily understand how habitual impressions increase in number and complexity; how they come to take different paths, are thus discriminated and issue in increased power and complexity of locomotion. The worm with its pigment cells can only creep; the insect with its myriad lenses has an incredibly delicate and rapid action of the wing, while blind insects are destitute of wings. And since the mouth is the prominent and alertest part of an animal, the visual organs are also situated near it. Hence also the proximity of an organ sensitive to vibrations of the air—the ear.

All these organs of sense are connected by sensory nerve-routes with ganglia which are closely associated, and collectively form the brain. Now when an animal is hungry, visceral impressions also ascend to the brain, and so coming into contact with the sensory ganglia, stimulate the senses, and awaken the intellectual and motor activities.

To sum up, we find the size and organisation of the brain proportional to the development of the sense-organs. As a result of increased brain organization we get increased complexity of exit routes and more manifold and differentiated muscular movements. Facility of locomotion widens the range of sense-impressions, and so reacts again on the brain, tending to develop it. Development is likewise faciliated by the struggle for existence. It is noteworthy, for example, that extinct birds had a smaller cranial capacity than existing birds.

A striking illustration of the dependence of our mental activity on sense-excitation is quoted by Bastian. A youth was under treatment, whose skin "was completely insensible, and that in respect to every kind of sensation. The most powerful electric current, or a burning taper held to the skin, was not able to produce any pain, or even a sensation of touch. Almost all the accessible parts of the mucous membrane of the body exhibited the same insensibility to pain. Also all those sensations which are classed together under the name of 'muscular sense' were entirely absent. The patient, when his eyes were closed, could be carried about round the room, his limbs could be placed in the most inconvenient positions, without his being in any way conscious of it. Even the feeling of muscular exhaustion was lost. In addition there came on a complete loss of taste and smell, blindness of the left eye, and deafness of the right ear.

"In short, here was an individual whose only connection with the outer world was limited to two doors of sense—to his one (right) eye and his one (left) ear. Moreover, both these remaining doors could at any time be easily closed, and in this way it was possible to investigate the consequences of completely isolating the brain from all external stimulation through the senses. If the patient's seeing eye were bandaged and his hearing ear were stopped, after a few minutes the expression of surprise and the uneasy movements which at first showed themselves, ceased, the respiration became quiet and regular; in fact, the patient was *sound asleep*. Here, therefore, the possibility of artificially inducing sleep at any time in a person simply by withholding from the brain all stimulation by means of the senses was realised."

It now remains for us to consider how, side by side with the increasing complexity in the relations of nerve-centres, the functions of mind are built up from the simpler forms of mental activity. We have to discuss the three functions of the mind, namely, the intellect, the emotions, and the will, as well as the difference between the me and the not-me—myself and the outside world. Mere discrimination is manifested in plants. The radicle, for example, always seeks the moist earth; the expanding leaves seek the sun and follow his course. In the evolution of the animal series more or less conscious discrimination follows on the differentiation of life-stuff into more and more definite nerve-tissue and more and more associated nerve-centres.

We have seen that particular stimuli follow particular nerve-tracts and are associated in particular centres. Centres of specialised *sensation* are acquired by the developing organism. Now, just as the phonograph repeats in fainter terms such vibrations of sound as it has registered, so do the nerve-centres become capable of repeating under stimulation the sensations that have traversed them. Thus did Hamlet reproduce his kingly father. "My father, methinks I see my father." "Where, my lord?" "In my mind's eye, Horatio." This function is *memory*. Memories, like sensations, fuse themselves into clusters. Constituents of memories of similar kinds also associate themselves together into *abstract ideas*. What is common to many experiences becomes separated in the mind from the experiences in which it is primarily found. For example, out of our manifold experiences of the properties of bodies we differentiate such abstract ideas as heat, light, weight. By reason of the associations of experience, the recognition of one quality of an object is sufficient to stimulate the faculties to the reproduction of all the qualities with which it is naturally united in the mind. Thus, I see a round yellow body which I believe to be an orange. The sight of it revives past impressions of touch, and taste, and smell, and hence I acquire what may be called the *perception* of an orange. This process takes place so rapidly that the combined effect is practically a single act of the mind. Having thus shown how the intertwining strands of nervous activity give us sensation, memory (that is to say, the revival of past registered impressions), perception, and abstract thought, I have a few words to say about instinct. The pups of dogs who have been taught to beg will often beg instinctively when hungry, although they have not themselves been taught the accomplishment nor learnt it from other dogs. This unconscious purposiveness of action is called instinct, and is only explicable by the theory of inherited acquisition; that is to say, that we must regard mind not merely as a continuous intelligent adaptation of internal to external relations, not merely as the co-ordinated experience of the individual, but as a faithful reflex of the experience of the race.

In a similar way to that in which the components of memory are associated together, and are capable of reproduction as abstract ideas, and of further association and discrimination as *reason*, so the memories of their beneficial or adverse action on the organism, that is to say, their pleasurableness or painfulness, are associated together so as to evolve vague but intense and pervading *emotions*.

The harmonious and orderly working of all my faculties and their interdependence gives me the sense of *personality*, to which emotion is directly related; while the different order in which sensations are related to one another—that is to say, their phenomenal order—as distinguished from the order in which they associate themselves with or affect my personality, unfolds the existence of the external universe. The same kind of mental process that combines related states of consciousness into a sense of my personality leads me to infer the existence of an external world.

Those particular kinds of emotion which we call desires and aversions are states of nervous tension leading to a conception of the kind of mental or bodily action which will relieve them. This is *volition*. Thus, then, we perceive that just as we can analyse brain action into its factors, so can we analyse the mind into its factors. Thus the progress of psychology and neurology, while it has placed our knowledge of mind on a scientific basis, has dissected into their natural unsubstantiality such ancient metaphysical ghosts as the ego, the non-ego, and the will.

In the same proportion as we find increased development of the senses, and as we find stimuli more and more combined and associated by nerve centres, so do we find a progress from simple reflex-action to discrimination of sensations, to consciousness, to brute, and finally to human intelligence. We can trace, for example, the influence of the reproductive stimulus from the simple mating instincts of the lower forms of life to the monkey who mourned his lost mate for several days, until finally, associated with all the faculties of the soul, it thrills in the gentle melody of Keats, inspires the divine genius of Dante, and ennobles even the humanity of Shakspere. Interwoven with all the faculties of emotion, it can at last express itself in the noble words of Brutus to Portia :—

> "You are my true and honourable wife,
> As dear to me as are the ruddy drops
> That visit this sad heart."

Or in a similar way we can trace the maternal stimulus through various grades up to its highest form, when it irradiates and adds a glory to the powers of an Elizabeth Barrett Browning.

We have ceased to regard mind as an entity. It is the commonest error of metaphysics to confound abstractions of the human mind with things in themselves. Thus the concept "heat" was confounded with a suppositious substance, "caloric." The phenomena of nerve have been confused into an entity called "mind." The term "mind" is an abstraction, like the terms "electricity" and "life." It is a mental symbol which stands for an infinite variety and combination of states And Von Baer's law, that the order of organic development is from the simple to the complex, is nowhere more manifest than in the realms of neurology and psychology.

Even subjective psychology reveals the composite nature of any single state of consciousness. While writing this I am at once thinking of what I write, I am willing to write; I have more or less consciousness of varied mental activity, of the room in which I sit, the objects and the people around me, and a thousand sensations either conscious or subconscious, while my pen forms the words I write with an automatic accuracy which is distinctly mental in nature, though not conscious. And neurology still further decomposes what at first would appear to be a simple state of consciousness into an infinity of components.

Unfortunately there is no time at my disposal to compare the comparative anatomy and function of the nervous system with comparative psychology. I must content myself with a rough sketch of the structure and functions of the nervous organs in man. Like the body itself, the nerves and nerve-centres are bilaterally symmetrical. The centres are either fused together or connected with each other by bands. The system may be roughly described as consisting of ingoing and outgoing nerves, and a central system of connected ganglia—the spinal cord and brain. All the ordinary nerves enter the cord. The nerves of the special senses enter the brain. The spinal cord consists of nerve-centres surrounded by nerve-fibres ascending to or descending from the brain.

The ascending or sensory fibres cross to opposite sides *in* the cord. The descending or motor fibres cross *above* the cord. The upper part of the cord is called the *medulla.* Above the medulla and in the brain-substance are two centres, one on each side, into which the ascending or sensory fibres of the cord pass as well as the ingoing nerves of the special senses. These are known as the *optic thalami.* Close by there are two other centres, one for each side, from which the descending or motor nerves take their origin. These are called the *corpora striata.* The optic thalamus of each side is connected by nerve-bands with its fellow on the opposite side, and with the corpus striatum of its own side. Above and around these centres is the great system of centres forming the surface of the brain, the *cortex.* Each half of the cortex is connected with its fellow of the opposite side, and every part with every other part by an infinite number of interlacing fibres. Ascending fibres reach it from the optic thalami and descending fibres pass from it to the corpora striata.

There are other centres of the brain, with which, in order to keep the subject as little complicated as may be, I shall not deal this evening. I have sufficiently demonstrated what I may venture to call the mail-route and chief sorting stations of the nervous system.

Let us inquire into the functions of these various parts.

When, as a result of injury, the spinal cord is divided at any point, all the parts supplied by nerves below the seat of injury become paralysed. Beyond that point the sufferer can neither move nor feel. But if you tickle the sole of the paralysed foot you will elicit a convulsive movement which is neither felt nor controlled; this is called reflex action. It is exactly what happens if you tickle the soles of a sleeping person. It is what happens when your finger is grasped by a sleeping child. But while the brain remains connected with the cord, a person may to some extent restrain reflex action.

Now if you decapitate a frog you may find a series of reflex actions much more complex than these. If you drop some acid on the thigh, the foot of the same side is raised and attempts to rub it off. If you cut off the foot the leg will attempt the same action, but, finding it impracticable the other foot will be raised for the same purpose. If you remove the whole of the brain, but leave the upper part of the cord or medulla intact, the animal will still continue to live and breathe. It will also swallow food. Sometimes human infants are born with only a cord and medulla. Such a brainless creature will suck and swallow as well as a perfectly formed child. The medulla then is the great co-ordinating centre for swallowing, for breathing, and indeed for many other actions. Destruction of the medulla destroys the possibility of all such movements and hence destroys life. Is this reflex action conscious? If you place a decapitated frog in water and apply gradual heat, the frog will die without making any attempt to escape, or manifesting the slightest inconvenience. This rather tells against the supposition that it is conscious in the sense in which the frog is a conscious animal. And the fact that very complex mental operations often occur unconsciously—a fact to which I shall have to refer farther on—naturally associates itself in our minds with the phenomena of reflex action.

There is evidence to show that the optic thalami receive and co-ordinate sensory impressions. Since the nerves of special sense enter the optic thalamus of the same side, while the nerves of general sensation cross over in the cord, it is plain that disease of the optic thalamus would affect the special senses of the same side, and general sensation on the opposite side of the body. Similarly disease of the corpus striatum paralyses half the face on the same side, and the opposite side of the body.

The fibres directly joining the optic thalamus to the corpus striatum furnish a route for the adjustment of movement to sensation without the nerve stimulus of necessity going round by the cortex.

Professor Ferrier has experimented on various portions of the cortex by mild electrical stimulation. He has made observations on monkeys and many other animals, and he finds that in all the same parts of the brain have a special importance in the performance of the same functions. Dr. Ferrier has demonstrated that specific areas of the brain are centres for sight, for hearing, for taste, for smell, and the organic sensations, and that different centres preside over different muscular movements. I once had under my observation a rustic who had received an injury to the speech-organ, which is well known to exist behind the left orbit. He had attempted to kiss a milkmaid. The young lady, with undoubted propriety but indefensible severity, had repelled him with a knitting-needle. The needle passed over the left eye and through the papery bones at the back of the orbit into the centre in question. The result was, that while intelligence was unimpaired, co-ordinated speech was impossible. The lad could understand what was said to him, but any attempt at reply on his part, when it came to anything at all, merely resulted in the use of quite a different word from what he intended.

There is a remarkable and well-authenticated case on record of a facile linguist who inflicted severe injuries by a pistol-shot on the frontal lobes of his brain. He recovered, but with the loss of two languages. He had literally shot them away, but he could still speak fairly well in a third.

We may say, then, that there is good ground for believing that special centres of the cortex subserve special functions. But when we remember the interwoven structure and interdependent parts of the nervous system, I think we must add that they do so with the concurrence and co-operation of the whole nervous system. There is evidence, I repeat, to show that scientific centres do not act independently of the concurrence of the entire nervous system.

Of one thing we are quite sure, that the development of the brain is proportional to the development of the mind. The development of the cortex is greater in civilised than in uncivilised races; it is greatest in men of undoubted mental superiority. It is greater in men than in the monkey, in the monkey than in the dog, and it decreases in the descending series with the decrease in animal intelligence. The weight of the brain is likewise, *cæteris paribus*, proportional to mental development. It is significant that in civilised communities wherein female intelligence has been comparatively uncultivated the female brain is smaller than it ought to be, while in savage tribes, where so much intelligent labour falls to the lot of woman, her brain bears favourable comparison with that of the man.

Measurements of the skull show that the modern Parisian brain is decidedly larger than was that of the Parisian of the Middle Ages. Moreover, degeneration of the brain accompanies the declining mental powers of advanced life, and is markedly noticeable in certain forms of insanity.

Are we, from the fact that body corresponds to mind, to conclude that we are mere mechanisms? For my part I entirely fail to see any analogy between an organism and a mechanism. If I make a clock I construct it to perform certain definite and invariable movements. The clock has no power of self-regulation or of development. Whereas life has been defined as the adjustment of internal to external relations. Mind and body grow and adapt themselves, and therefore cannot be regarded as automatic; on the other hand, mind and body fall strictly within the reign of law. If it were otherwise we could count neither on ourselves nor on others; there could be no such thing as character; our actions would be variable as the wind. If similar antecedents were not invariably followed by similar results, education would be an impossibility and responsibility inconceivable.

There is another interesting point to which I should like to draw your attention. Not merely can I analyse my mind into factors, strongly, fairly, or faintly conscious, but my mind will work in an unconscious manner; or to be more precise, the mind will continue to reason and to direct independently of personal consciousness. The judgment, the expression of organised experience, often manifests itself as the result of an unconscious development. Moreover the mechanical details of writing, talking, walking, and playing musical instruments come to be performed without conscious direction. If we forget a name it will often subsequently recur without effort. This can only be explained by the theory that a certain train of nervous action having been started in the cortex, a series of organic changes occurs, which eventually issues in the production of the forgotten name in consciousness. There is good evidence that by far the larger part of our mental operations take place outside of personal consciousness.

Let us consider this point for a moment. Clearly we must extend the term mind to cerebral activity even when unaccompanied by personal consciousness. But cerebral activity is nothing but the activity of a complicated system of nerve-cells. Each separate nerve-cell exhibits in itself the essential activities of a system of nerve-cells. Nerve-cells again are differentiated protoplasm, and, as I stated in the early part of this address, it is significant that undifferential protoplasm exhibits a crude form of nervous activity. It discriminates, it is sensible of difference, it chooses. We must, therefore, still further amplify our conception of mind. We are bound to suspect that there is a mental or quasi-mental reality accompanying all protoplasmic phenomena. And the same conclusion as to the mentality of protoplasm is reached when, in watching progressive development from the ovum, we gradually arrive at that startling result—animal intelligence; or when we attempt to trace the development of mind in racial evolution. Nature makes no leap into mentality or into consciousness, either in the individual or the race. Can we stop short at protoplasm?

Having extended the scope of mentality to the vegetable world and the lower forms of life, are we compelled to halt there? If the inorganic passes by evolution into the organic; if they form one series; if protoplasmic motions enter, as we have every reason to believe they do, into the circle of the modes of motion; in other words, if protoplasm is natural in origin and function, I do not see how we can draw a hard and fast line for mentality at protoplasm, any more than we can draw a hard and fast line at personal consciousness.

We are at least logically bound to extend the term *mind* to all such nervous activities as ultimately find an expression in consciousness. We are, I take it, further bound to seek its factors in the antecedent stimuli which operate on the nervous mechanism from without. Just as we regard any particular function of the mind as accompanied by a general operation of the nervous system with special reference to a particular area, so are we bound to regard consciousness as a culmination of all its antecedents in space and time, with a special reference to the particular organism in which it may appear. You may have perceived that I have already dropped a hint as to the real nature of the external world. I will consider the question in a little more detail.

Let it not be forgotten that all that we know of the external universe we know in terms of our personal consciousness—we know in terms of mind. If I listen to a musical note the sound is neither in the instrument nor in the vibrations of the air, though it proceeds from both; it exists in my mind. I do not necessarily see the same thing of the same colour as another man. Two friends of mine cannot distinguish green from red. A respectable Quaker is stated to have horrified his wife by donning a bottle-green coat and presenting her with a lovely scarlet merino, under the impression that both were a quiet drab. It is clear that the sense of colour is in the mind. But it is equally indisputable that different colours are due to different external causes. It is an elementary proposition in psychology that we have no reason to suppose that things in themselves are what they to appear to be. To take another example, I have every reason to conclude that some lower animals posesss senses of which I do not possess the faintest rudiment. It is clear that the reality which corresponds to the external world cannot be as we perceive it. We symbolyse the universe in our thought. What we perceive corresponds to that which is, in the same sense that my written name corresponds to me. It stands for me; it represents me.

Can we form any conception of what nature really is? To attempt an answer I shall first ask whether the mind, which symbolises nature, is something supernatural and outside of nature. That there is a correspondence, absolute and invariable, between mind and body may be taken as established. But I think we may go farther than this. If the body is affected by the mind and the mind by the body, it is impossible to consider the mind as a mystery lying outside the confines of nature. I repeat that now that the indestructibility of what we call matter and the conservation of what we call energy are established, mind cannot be conceived of as altering matter, or as entering into the circuit of the forms of energy, if it differs absolutely from that which it affects. And the same irresistible conclusion is arrived at when we watch the gradual growth of the individual mind, or review the development of mind in the animal series. The indestructibility of matter and the persistence of energy leave us no room for an influence outside the closed circuit of the universe. To day scientific thought is only possible on this assumption. There is proof of evolution—that is to say, of change and development of state. There is no proof of a non-natural, non-material entity. Speculation is bounded by the confines of nature. And the fact that mind may fall out of personal consciousness without ceasing to be mind, which is what we mean by unconscious cerebration or unconscious cognition, is very suggestive. For since the nervous system corresponds so exactly to the mind; since all that we know of the action of the brain we know in terms of mass and motion—that is to say, that its chain of cause and effect would appear to be strictly what is ordinarily known as a material succession; since, as I have shown, all that we know we know in symbols merely; since mental evolution proceeds, *pari passu*, with organic evolution; and, lastly, since mind can be shown to exist apart from personal consciousness, I would ask what greater reason any one has for assuming that the symbols of the external world represent a real thing outside of mind, independent of it, and in no sense mental, than he has to assume that mind is an entity outside of nature, independent of it, and in no sense natural. I would venture to suggest that if you could see my brain working you would really see the operations of my mind translated into the terms of sight; symbolised, that is to say, as a material presence, in order to your apprehension. Dualism is gratuitous.

If this be true, and it is an inference from which I can see no escape, the operations of mind and brain are identical, the one being perceived in terms of and relegated to the order of our personality, the other perceived by the senses, and belonging to the order of our sensation. If this be true, matter is an abstract term denoting sensorial impressions. The nervous organisation is the fact of the mental organisation expressed in the terms of the senses. I perceive the fact of an existence outside myself in the form of nature. This external existence and the mind are akin to and re-act on one another. Nay, more, the mind proceeds from this external existence. Matter, like space and time, is a condition of conscious representation. The universe, as we perceive it, is so far a representation of the Eternal Mind.

To sum up. What we speak of as material changes invariably accompany mental changes. We have no evidence that the universe is truly material, nor have we any evidence that it is conscious; but, as I venture to think, we have some grounds for inferring that it is mental. Whether it is anything else, and if so, what, we do not, we cannot know. Man is limited to his own consciousness: his perceptions are symbols; his reason gives him but a probable inference. It is his prerogative that Truth stands open to him like a fair temple with welcoming gates; but with a limitation. For perchance, though man may wander at will amidst the varied treasures of the outer court, he must ever sit with bowed head and bated breath at the gates of the inner sanctuary.

PROCEEDINGS.

APRIL 12TH, 1883.—ORDINARY MEETING.

MR. WM. BOULTING, L.R.C.P.,

President, in the Chair.

THE Minutes of the previous meeting were read and confirmed.

The donations to the Museum were announced and the donors thanked. Miss James presented to the Library, "The Collected Papers of Garrod," and a vote of thanks was accorded her.

Two gentlemen were proposed for membership.

MR. A. C. CLAUDET, A.R.S.M., read a paper on "THE INTERIOR OF THE EARTH." He commenced by mentioning the vague ideas generally held with regard to the condition of the interior of our globe. There is, however, one thing certain—although our absolute knowledge of the interior is small—and that is, that at some depth beneath our feet there exists great heat. Confirmation of this is everywhere to be obtained, for in the sinking of shafts for mines and wells, and in the borings made in various parts of the world, an increase of temperature always occurs as greater depths are attained. The average increase of temperature, as deduced from many experiments, has been estimated at 1 deg. Fahr. for every sixty feet of descent. The form of the earth—an oblate spheroid—is that which would be assumed by the gradual cooling of a molten body. The nebular theory of the universe was explained, showing that the sun was the nucleus of a luminous mass which revolved on its axis, and extended far beyond the orbits of the most distant planets, which at that time were not formed. The diminution of temperature caused the nebulæ to contract, and the rapidity of rotation caused portions to be thrown off, and the further condensation of these detached masses formed the planets and satellites. The proofs of internal heat are volcanos and earthquakes, hot springs, borings, wells, and mines. Each of these was then explained, and the theories of volcanic action discussed. The importance of the examination of meteorites as helping to solve the problem of the composition of the interior of the earth was described. The greater density of the earth, as a whole, compared with the rocks at the surface, leads to the idea that metallic substances, probably iron, abound near the centre. The various theories of the condition of the interior of the earth, resulting from a slow cooling of a molten mass, were discussed. Some supposed it to have solidified at the centre and crust at the same time, others maintaining that the interior is liquid and confined by a thin shell or crust of a thickness varying from fifty to two hundred miles. The lecturer then stated the theories of volcanic action, and referred especially to the theory that some metals, when under certain conditions of temperature and pressure, are able to absorb many times their volume of certain gases, and, on cooling, these gases are given off or occluded. Molten silver absorbs oxygen from the atmosphere, and on cooling gives it out again with considerable force. This "spitting" of silver, as it is termed, resembles very closely the action of a volcano, small cones and streams of metal being formed very like those in volcanic regions. At the conclusion of the paper a discusion ensued, in which the president, Mr. R. M. Gordon, Mr. R. Ellis, Mr. Leigh Hunt, and Mr. C. H. Watkins took part. A vote of thanks was accorded to Mr. A. C. Claudet, and the meeting terminated.

MAY 10TH, 1883.—ORDINARY MEETING.

MR. WM. BOULTING, L.R.C.P.,

President, in the Chair.

The Minutes of the previous meeting were read and confirmed.

The donations to the Museum and Library were announced, and the donors thanked.

Dr. Herbert Cooper and Mr. W. J. Palmer were elected members of the Club. MR. F. H. HAINES read a paper on "LOCAL BIRDS."

The lecturer commenced by giving a short sketch of the classification of birds, explaining the grounds upon which it was founded. Examples were then taken of each of the orders into which the great class of *Aves*, or birds, is divided. As an example of the *raptores*, or birds of prey, the kestrel hawk was noticed. This bird, which is often to be seen hovering over fields in the neighbourhood, has a habit of usurping possession of the uninhabited nests of crows and magpies, and if inhabited expelling the rightful owners by force. Although the lecturer considered these birds harmless to the gamekeeper, and certainly useful to the farmer from its habit of feeding upon field-mice, yet, he stated, occasionally they would feed upon small birds, and he cited an instance which had come under his own observation, in which twenty-three birds were discovered in one nest. As a second example of this order, a specimen of the short-eared owl (*Otus brachyotus*) was exhibited. This specimen was obtained by the late curator of the club (Mr. J. S. Ellis) in a field near North End. It has a habit of depositing its eggs in rabbits' holes, resembling in this repect the well-known burrowing owl of the American prairies. The second order, the *insessores*, by far the most extensive English order, is divided into four groups:—1. *Dentirostres*, or tooth-billed; 2. *Conirostres*, or cone-billed; 3, *Scansores*, or climbers; 4. *Fissirostres*, or cleft-billed birds. The red-backed shrike (*Lanius collurio*) was taken as an example of the first sub-division. This bird has the habit of affixing to thorns various beetles, either as food or as bait for certain small birds upon which it preys. The shrike mimics the songs of other birds. Of the thrush family many specimens were exhibited, some of which were shot in the neighbourhood. In speaking of the warbler family, the lecturer mentioned the great loss the Heath had sustained by the draining of the marsh by the Board of Works, and showed that many species of this interesting family had become much scarcer owing to this act of ignorance and folly. Not a few of these delicate-looking little birds sing by night as well as by day, and their voices may be heard when most other birds are silent. The *conirostres*, or cone-billed birds, were next described. The skylark belongs to this group. These birds sometimes assemble in flocks so vast that when settled they cover several acres of ground. The *scansores* were next described, the wryneck and lesser spotted woodpecker being taken as examples. Attention was drawn to the sharp recurved claws and stiff forked tail, which, by a long series of modifications, had reached a state so well suited to birds of climbing habits. The cuckoo was referred to before passing on to the *fissirostres*, of which group a kingfisher had been observed in North End. The *rasores* were illustrated by members of the *columbidæ* and *phasianidæ*, and the *grallatores* by the common heron (*Ardea cinerea*), which is, however, but rarely seen in the neighbourhood. The paper concluded by an account of the wild-duck and the common dabchick as examples of the *natatores*. The paper was illustrated throughout by specimens of birds' eggs and nests from the Club's collection. After a discussion, in which Dr. Boulting, Mr. Roland Ellis, and Mr. T. R. Keys took part, a vote of thanks was accorded to Mr. F. H. Haines, and the meeting terminated.

JUNE 14TH, 1883.—ORDINARY MEETING.

MR. WM. BOULTING, L.R.C.P.,

President, in the Chair.

The Minutes of the previous meeting were read and confirmed.

The donations to the Museum and Library were announced, and the donors thanked.

A fine collection of lizards, snakes, scorpions, &c., from Egypt, was presented to the Club by Mr. Frank G. Howard, with a donation of 30s. A special vote of thanks was accorded him.

One gentleman was proposed for membership.

It was announced that the Report of the Committee and President's Address had been printed together, and were now published.

A paper was read by MR. ROLAND ELLIS on the "PHYSIOLOGY AND HABITS OF THE HIVE-BEE."

The lecturer began by stating that a great deal was known about the hive-bee when compared to other insects, and referred this fact to the circumstances of its great use to man and to the beautiful modification of its various organs. He then proceeded to describe the nearest relations of the bee in the order Hymenoptera, and mentioned the humble-bee and others, the gall-flies, saw-flies, ichneumons, wasps, hornets, and ants. The characteristics of the order were discussed, and he showed how the legless condition of the larva of the bee had come about. By the aid of diagrams the lecturer then explained the differences between the three conditions of the insect—the queen, drone, and worker—and proceeded to describe their physiology. He mentioned that the antennæ were supposed to convey sounds as well as impressions of contact, showed that the insects were not able to appreciate low sounds, and said it was more than probable that their power of appreciating sounds commences at or near the point where our power leaves off. The antennæ seemed also appropriated to the transmission of impressions of which we are ignorant. He then mentioned the complex eyes, with their hundreds of lenses, and proceeded to describe the mouth parts, which are specialised to a very high degree, and which by a series of diagrams he showed to be the accumulated result of many successive variations in one direction. The great length of the flexible tongue enables the insect to visit deep flowers which would otherwise be inaccessible to it, and thus by natural selection the extraordinary form it now presents has come about. He showed in support of this how important to the individual bee even a slight lengthening of its proboscis would be, as whole families of plants would thus be thrown open which would be denied to a shorter-tongued form. Mr. Ellis next described the hind legs, which are wonderfully adapted for carrying pollen. The sting next claimed the attention of the audience. The structure of the sheath, the lancets, and the poison reservoir and gland, was carefully described, and their operation explained. From its structure, with recurved barbs, the sting cannot be withdrawn when once plunged to the hilt, so that the insect in trying to escape tears out its viscera and dies. It seems, he said, a most extraordinary thing that Nature, in providing weapons of defence to the insect, should not allow them to be used without causing the destruction of the owner; but when we refer to the other members of the order, and find a saw-fly, which has a serrated anal instrument for ovi-position, and a gall-fly, which has a piercing instrument which also ejects an irritating fluid, the mystery is solved, and in a combination of these two the morphological significance of the structure of the sting of the hive-bee is apparent, and, in the words of Darwin, if we look at the sting of the bee as having existed in a remote progenitor as a boring serrated instrument, which has since been modified but not yet perfected for its present purpose, with the poison originally adapted for such an object as the production of galls and since intensified, we can understand how it is that its use should so often cause the insect's death. Passing on to the third heading of this paper, the lecturer described the life history of the insect from birth to death, explained the method of making honeycomb, and related the well-known incident of Rèaumur, Kœnig and McClaurin in relation to the angles at the base of the cells, showed how the hexagonal form had come about, described the process of swarming, and enumerated the various enemies against which the bee has to contend in the struggle for existence. A brief summary of the whole subject concluded the paper, and a discussion ensued, in which Mr. Boulting, Mr. F. L. Watkins, and others took part. A hearty vote of thanks was proposed to Mr. Ellis, and carried with acclamation.

JULY 12TH, 1883.—ORDINARY MEETING.

MR. WM. BOULTING, L.R.C.P.,

President, in the Chair.

The Minutes of the previous meeting were read and confirmed.

The donations to the Museum and Library were announced, and the donors thanked.

Mr. E. B. Stamp was elected a member of the Club.

One gentleman was proposed for membership.

The President remarked that in answer to inquiries of the committee, the Board of Works had promised to provide a specimen of every plant growing on the Heath for the Museum. This will be a great boon to the Club, as many plants had become extinct, owing to the recent drainage.

A paper on "THE SKIN AND ITS MODIFICATIONS," by DR. PERCY TAYLOR, was communicated by Mr. F. L. Watkins.

At the conclusion of the paper a discussion ensued, in which Mr. R. Ellis, Mr. Jackson, and the President took part. A vote of thanks to Dr. Taylor was carried unanimously. The President supplemented the paper by a few remarks on "Cells and Cellular Structure." A number of objects were exhibited under microscopes by Messrs. C. A. Watkins, J. E. Stuart, and H. Jackson.

OCTOBER 10TH, 1883.—ORDINARY MEETING.

MR. WM. BOULTING, L.R.C.P.,

President, in the Chair.

The Minutes of the previous meeting were read and confirmed. The donations to the Museum were announced and the donors thanked.

Mr. J. Wellings was elected a member of the Club.

Seven gentlemen were proposed for membership.

A lecture was delivered by PROFESSOR T. G. BONNEY, M.A., F.R.S., &c., on "THE OLD VOLCANOES OF BRITAIN."

The lecturer commenced by comparing the present condition of Britain with the active volcanic districts of the globe, and stated that our islands had been the scene of volcanic outbursts on as grand a scale as those which had recently taken place in Java. The structure of volcanic mountains was described, being built up of loose materials and molten rock in a conical form, with a central pipe or crater communicating with the interior portions of the earth. The various volcanic rocks were enumerated and their classification explained as being based on the quantity of silica contained in them. Prof. Bonney described the classification of the sedimentary rocks from the oldest or Paleozoic through the Mesozoic to the Tertiary and recent epochs, with their subdivisions into systems. The positions of the chief centres of volcanic action were pointed out in North and South Wales, Shropshire, Charnwood Forest, Derbyshire, and parts of Scotland. In the earliest geological time, known as the Pre-Cambrian epoch, volcanic eruptions took place on a grand scale, the remains of which are seen in the Wrekin and Charnwood Forest, St. David's Head in South Wales, and in Scotland. In Cambrian and Silurian times enormous masses of rock, many thousands of feet in thickness, were formed by the lavas and ashes ejected by volcanoes in the Lake District and parts of North Wales, Snowdon being composed of volcanic materials ejected at this period. During the Devonian Period Scotland possessed several large volcanoes in the Grampians. The structure of the hill known as Arthur's Seat, near Edinburgh, was explained as being the denuded remains of a volcano, which was active during the Coal Period. In Miocene times Scotland was the scene of great volcanic activity, the remains of these volcanoes being well seen in the islands of Skye, Mull, and Rum. The lecturer described in detail the structure of the Isle of Eig, on the west coast of Scotland, showing that it is the portion of a lava stream which had flowed from a volcano at a considerable distance, and which had long since been destroyed by denudation. The lecturer concluded by a reference to the enormous length of time occupied by these various geological changes. A vote of thanks to Prof. Bonney was proposed by Mr. F. W. Rudler, F.G.S., and seconded by Mr. F. Baines, and, after some remarks by Dr. Hicks, F.G.S., was carried unanimously. Prof. Bonney having replied, the meeting terminated.

NOVEMBER 14TH, 1883.—ORDINARY MEETING.

MR. G. DOUGLAS PIDCOCK, B.A., M.B.,

Vice-President, in the Chair.

The Minutes of the previous meeting were read and confirmed. The donations to the Museum were announced, and the donors thanked.

The following gentlemen were elected members of the Club: Mr. A. G. Cowell, Dr. L. Süss Hahnemann, Mr. L. S. B. Hahnemann, Mr. H. P. Hill, Rev. J. Kirkman, Mr. T. C. Matheson, and Dr. Richard Neale. One gentleman was proposed for election.

The PRESIDENT delivered a lecture on "THE MECHANISM OF THE VERTEBRATE HEART." After a few preliminary remarks on the structure and functions of the blood in various animals, the lecturer described the mechanism of the circulation in various classes, and compared the development of the heart in mammals with the adult condition of that organ in lower forms of life as illustrating the doctrine of the common origin and descent of living beings. He concluded with a reference to Harvey's immortal work, which he said was accomplished by vivisection. For Harvey says, "When I first gave my mind to vivisections as a means of discovering the motions and uses of the heart, and sought to discover these from actual inspection, and not from the writings of others, I found the task so truly arduous, so full of difficulties, that I was almost tempted to think with Fracastorius that the motion of the heart was only to be comprehended by God." But "the motions of the heart as seen in the dissection of living animals," led him to a result which is the basis of all modern medicine. At length, as Harvey expresses it, he "discovered what he had so much desired," "by using greater and daily diligence, having frequent recourse to vivisection, employing a variety of animals for the purpose, and collating numerous observations." The lecturer thought there could be no question of the folly of anti-vivisectionist sentimentalism as opposed to judicious investigation. Notwithstanding the rapid progress of physiology and practical medicine under a vivisectionist *régime*, problems as stupendous as that which occupied Harvey yet remain to be solved, and the solution lies in a similar method, and can only be attained by a similar earnestness and tenacity of purpose; for observation and comparison are, as Linnæus pointed out, the royal roads to knowledge. A vote of thanks was awarded to the lecturer, proposed by Mr. C. A. Watkins and seconded by Mr. E. B. Stamp.

DECEMBER 12TH, 1883.—ORDINARY MEETING.

MR. WM. BOULTING, L.R.C.P.,

President, in the Chair.

The Minutes of the previous meeting were read and confirmed. The donations to the Museum were announced, and the donors thanked.

Mr. Wm. Hornibrook was elected a member of the Club. One gentleman was proposed for membership.

A paper was read by MR. SPENCER MOORE, F.L.S., on "THE MIMICRY OF ANIMALS BY SEEDS, WITH ESPECIAL REFERENCE TO THE EUPHORBIACEÆ." The lecturer having cited cases from Belt's "Naturalist in Nicaragua," showing how important a part is played by mimicry in a tropical country, proceeded to explain the structure of the carunculate euphorbiaceous seed, and the origin of the appendage or caruncul us as an outgrowth of the placenta, which, after fertilisation, attaches itself to the tissue of the ovule in the neighbourhood of the micropyle. Attention was then drawn to the difference in nutrimental qualities between the delicate aleurone-containing endosperm tissue and the thick-walled aleurone-less cells of the caruncul us with their small quantity of protoplasm and mere traces of starch. Comparison was then made, by means of enlarged figures, of certain seeds with compatriot arachnida and insects. The small castor-oil seed was shown side by side with one of the "carapatos" of the Brazilians, the testa closely resembling in form, ground-colour, and marking the body of the carapato, whose rostral apparatus was simulated by the caruncul us. A large local form of the seed was also compared with a local tick (*Ixodes hippopotamensis*, Denny), and a purple black south tropical African variety, shown to be very like a tick in the British Museum from Fernando Po. Other seeds, which it was suggested might resemble ticks, were the Indian *Tatropha curcas*, Roxb, *Croton reticulatus*, Heyne, and *Balisspernum montanum*, Roxb. Success, however, had not yet crowned the efforts to discover their tick-mimics, owing, in all probability, to the slight attention which the group has received at the hands of entomologists and travellers. Other seeds, almost all with a relatively large carunculus, closely resemble compatriot beetles, belonging especially to the groups *Chrysomelidæ* and *Cassididæ*. The "raphal line" of the seed represents the line between the closed elytra, and divides the testa into two elytra-like halves, and the mimicry is completed by the prothorox-like carunculus. It was then shown that, although there can be no doubt of the resemblance between seed and insect, it is very difficult to come to a conclusion as to which is the mimicing and which the mimicked organism. For the carunculus, which may structurally represent an aborted ovule, it is impossible to suggest any function other than mimicry-completion; on the other hand, there seems large warrant for the assumption that the beetle derives benefit from its resemblance to the seed. Under these circumstances it was suggested that a parallel mimicry might obtain here, the insect and the seed originally showing some general likeness sufficient to throw off their scent the more unwary of the enemies of either, and that the mimicry might then become more and more perfect by the ordinary operation of natural selection. In order, however, to establish this view, the necessity of observation in the tropics was insisted on. A vote of thanks to Mr. Moore was then proposed by Dr. Herbert Cooper, and seconded by Mr. C. A. Watkins, and, after a few remarks from the lecturer, the meeting terminated.

JANUARY 16TH, 1884.—ORDINARY MEETING.

MR. WM. BOULTING, L.R.C.P.,

President, in the Chair.

The Minutes of the previous meeting were read and confirmed.

Mr. W. Collett was elected a member of the Club.

Mr. O. Bevil Granville proposed a vote of thanks to Mrs. Ellis for her kindness in having allowed the Club free use of a room for the Museum and Library since the formation of the Club. The collection had now outgrown this accommodation; but without the assistance of Mrs. Ellis the Museum could not have reached its present dimensions. Mr. R. M. Gordon seconded the vote of thanks, which was carried unanimously.

A lecture was delivered by MR. F. W. RUDLER, F.G.S., on "THE NATURAL HISTORY OF THE DIAMOND." The lecturer gave a short history of the use of precious stones for ornamentation, pointing out that in the earliest times the diamond was not valued so highly as other gems, probably in consequence of the difficulty of cutting it, the method being then unknown. Although the diamond is mentioned in the early Scriptures as one of the stones in the breastplate of the high priest, the stone referred to was most likely a species of onyx, as the diamond could not have then been engraved as those stones are said to have been. In early times the diamond was confounded with the mineral known as rock crystal, which is pure silica crystallised in transparent six-sided prisms. Pliny, in his "Natural History," makes the first reliable record of diamonds in an account of six stones, from which description three of them can be recognised as diamonds, the others being rock crystal. The geometrical forms which mineral substances assume under favourable circumstances in passing into a solid state are called crystals, from the Greek word *krustallos*, ice—as the ancients imagined all crystallised minerals to be petrified ice. The difference between a crystallised and an amorphous substance was explained, the former being built up from within upon definite lines, the latter being fashioned by external action. The study of the geometric forms of minerals by careful measurements of the angles of their facets by the Abbé Haüy early in the present century resulted in a system of crystallography, showing the relation which these angles bear to the axes of the crystal around which the molecules are arranged with such order and precision. All known crystals are now arranged under six systems, according to the positions of their axes. The diamond is referred to the cubic system, in which there are three equal axes at right angles to each other. This the lecturer illustrated by drawing on the blackboard diagrams of the simple cube and its various modifications in the octohedron and dodecahedron, common forms of the diamond. The diamond is the hardest mineral known ; no other body can scratch it, yet it can be easily pulverised, and, like other crystalline minerals, pieces can be chipped off, provided the cut be made along the plane of cleavage, *i.e.* in a line with one of its faces. In this way diamonds are reduced in size before the operation of grinding the stone into the shape required by the jeweller. The only useful application of the diamond is for cutting glass, but of late years an amorphous and tough variety known as bort, or carbonado, has been set on the edges of boring tools, which arrangement has enabled the engineer to bore the hardest rocks. The optical properties of the diamond, combined with its hardness, give the value to the stone. The beautiful adamantine lustre of a fine, well-cut diamond arises from its very high refracting power, and Newton, without any knowledge of its chemical nature, but reasoning entirely from the results of his experiments on other highly refractory bodies, such as essential oils, surmised that the diamond might be a combustible substance. Mr. Rudler described several experiments that had been made by wealthy persons to discover what this stone really was, but it was not until Smithson Tennant, an English chemist, burnt a diamond in oxygen, and, after weighing the gaseous product, discovered that an equivalent of carbonic acid gas remained corresponding to the weight of the stone consumed, thus proving that the diamond is pure crystallised carbon. The progression in the amount of carbon from wood to diamond was explained. Lignite, a woody coal, contains from fifty to seventy per cent. of carbon ; house coal from seventy to ninety ; anthracite, a homogeneous coal, contains sometimes as much as ninety-eight per cent. of carbon ; graphite, or blacklead, contains only a trace of impurities ; and the diamond is absolutely pure carbon. From these and other important facts which have been brought to light from the examination of diamonds, an organic origin is claimed for this stone. The chief diamond localities are India, Brazil, Borneo, Australia, and recently South Africa, in which colony they were discovered about fifteen years ago at Kimberly, on the Vaal River. The Indian fields are the oldest, and most of the finest stones have been found there, but many good stones have lately come from the Cape, which yields the largest supply. From a study of the mode of occurrence of diamonds in the soft rock of these South African mines, a volcanic origin has been suggested, and the recent experiments in this direction by Mr. Hannay, of Glasgow, who has produced diamonds artificially, has strengthened this idea. Hannay found that when a gas containing carbon and hydrogen is heated under pressure in the presence of certain metals, its hydrogen is attracted by the metal and carbon set free in the clear transparent form of the diamond.

The lecture was illustrated by several excellent diagrams and by a beautiful series of models of historic diamonds, and by several native diamonds, kindly lent by Mr. E. W. Streeter, of New Bond Street. The interest of the exhibition was much enhanced by the information relating to the histories, possessors, and values of these gems, afforded by Mr. Abbot, who was so good as to attend the meeting in charge of this valuable collection.

FEBRUARY 13TH, 1884.—ORDINARY MEETING.

MR. WM. BOULTING, L.R.C.P.,

President, in the Chair.

The Minutes of the previous meeting was read and confirmed.

A paper was read by DR. HERBERT COOPER on "PHYSIOGNOMY." At the conclusion of the paper a discussion ensued, in which the following gentlemen took part: Mr. E. Bell, Mr. C. A. Watkins, Rev. M. G. Tracey, M.A., Mr. A. Bakewell, Mr. T. R. Keys, and the President. A vote of thanks to Dr. Cooper was proposed by Mr. W. Leigh Hunt, and seconded by Mr. W. Hornibrook, and carried unanimously.

MARCH 12TH, 1884.—ORDINARY MEETING.

MR. WM. BOULTING, L.R.C.P.,

President, in the Chair.

The Minutes of the previous meeting were read and confirmed.

Three gentlemen were proposed for membership.

A paper was read by MR. O. BEVIL GRANVILLE entitled "THE EYE," at the conclusion of which a discussion ensued, in which the following gentlemen took part: Mr. C. A. Watkins, Mr. W. Collett, Mr. E. Bell, and the President. A vote of thanks to Mr. Granville was proposed by Mr. C. A. Watkins, and seconded by Mr. W. Collett.

FOURTH
ANNUAL REPORT OF THE COMMITTEE.
SESSION 1883-84

YOUR Committee are pleased to report that the condition of the Club is satisfactory, although there has not been a large increase in the number of Members. During the Session sixteen Members have been elected and twelve resigned, making the present total fifty-four against fifty last year. The ordinary meetings have been very well attended, and your Committee again suggest to Members the desirableness of bringing objects of Natural History in which they are interested to these meetings for exhibition.

The following Papers were read:—

1883.	April 12 .	"The Interior of the Earth," by Mr. A. C. Claudet, A.R.S.M.
"	May 10 .	"Local Birds," by Mr. F. H. Haines.
"	June 14 .	"The Physiology and Habits of the Hive-Bee," by Mr. Roland Ellis.
"	July 12 . .	"The Skin and its Modifications," by Dr. Percy Taylor.
"	Oct. 10 .	"The Old Volcanoes of Britain," by Prof. T. G. Bonney, M.A., F.R.S.
"	Nov. 12 .	"The Mechanism of the Vertebrate Heart," by Mr. Wm. Boulting, L.R.C.P.
"	Dec. 12 . .	"The Mimicry of Animals by Seeds," by Mr. S. Moore, F.L.S.
1884.	Jan. 16 . .	"The Natural History of the Diamond," by Mr. F. W. Rudler, F.G.S.
"	Feb. 13 .	"Physiognomy," by Dr. H. Cooper.
"	March 12 .	"The Eye," by Mr. O. Bevil Granville.

Your thanks are due to Professor T. G. Bonney, M.A., F.R.S., Dr. Percy Taylor, and Mr. Spencer Moore, F.L.S., for the Papers they contributed during the Session.

The following Excursions were made—

1883.	May 19 .	To Boxhill and Dorking.
"	June 16 .	To Mr. F. G. Horniman's Museum at Forest Hill.
"	" 30 .	" " "
"	July 7 .	To Leith Hill and Ockley.

Your thanks are due to Mr. F. G. Horniman, of Surrey Mount, Forest Hill, for his great kindness in inviting the Members and their friends on two occasions to visit his fine collections and for the hospitality they received.

The Balance-Sheet shows that the financial condition of the Club is satisfactory.

In consequence of the Museum having outgrown the accommodation so kindly given by Mrs. Ellis at North End, your Committee have stored the specimens until sufficient funds are forthcoming to enable them to rent suitable rooms.

Your thanks are due to Mrs. Ellis for her generosity in having allowed the Museum to be at her house, there being no doubt that but for this assistance it could not have attained its present dimensions. The appeal to Members for a Rent Guarantee Fund has been well responded to, but a sufficient sum is not yet subscribed to enable your Committee to provide the necessary accommodation.

For the last three years some few of the members have made systematic notes on the appearance of birds and the occurrence and times of flowering of plants, &c., within a three mile radius of our Museum, a list of which observations will be found at the end of this Report. In a neighbourhood like Hampstead, where the open spaces are being so rapidly covered, notes of this kind will become valuable, as it has been observed that many species of plants which flourished here a few years ago have disappeared. The recent drainage of the Heath has caused the extinction of a great many plants. Your Committee would urge Members to take notes of the occurrence and times of flowering of plants in our neighbourhood and communicate them to the Club, and thus help to complete the small list which has already been made out.

Your Committee have to announce some changes in the officers of the Club. Mr. Wm. Boulting, L.R.C.P., who has so ably presided at our meetings for two years, and who has devoted so much of his valuable time to the affairs of the Club, retires from the presidential chair.

Your Committee propose for election Mr. Charles A. Watkins as President, and Mr. F. W. Rudler, F.G.S., as Vice-President, and they hope the list of Officers and Members of Committee will meet with your approval.

Your thanks are due to the following gentlemen who retire from the Committee—Mr. F. Haines, F.S.A., Mr. M. Moir, and Mr. F. H. Haines.

Hampstead Naturalists' Club.

BALANCE-SHEET FOR THE YEAR ENDING MARCH 19TH, 1884.

Receipts.	£	s.	d.	Payments.	£	s.	d.
Balance from last Account	1	17	6½	Museum	3	0	0
Subscriptions	17	15	0	Library	1	6	7
Donations	2	12	1	Stationery	1	8	8
Sale of Reports	1	11	0	Postage	2	17	6
				Printing	9	10	6
				Gas and attendance	2	5	6
				Advertisements	1	14	4
				Sundries	0	6	8
				Balance in hand	1	5	10½
	£23	15	7½		£23	15	7½

We have this day examined the Treasurer's accounts and found them correct.

LOUIS BLUMFELD, } *Auditors.*
T. R. KEYS,

March 19*th*, 1884.

LIST OF MEMBERS.

Honorary Members.

S. A. NOTTCUT, 98, Anglesea Road, Ipswich.
JOHN M. CAMPBELL, Joint Secretary, Glasgow Natural History Society, Kelvin Grove Park, Glasgow.
G. S. JEALOUS, 1, Villas on the Heath, Hampstead, N.W.
JOHN MORRIS, M.A., F.G.S., 4, Vinery Villas, Park Road, N.W.

Ordinary Members.

Date of Election.	
Dec. 14, 1881	BARHAM, GEORGE TITUS, Danehurst, Haverstock Hill, N.W.
April 19, 1882	BEETON, HENRY RAMIÉ, 42, Belsize Square, N.W.
July 4, 1880	BLUMFELD, JAMES L., Brauneck, Prince Arthur Road, Hampstead, N.W.
July 10, 1880	BLUMFELD, JOSEPH, Brauneck, Prince Arthur Road, Hampstead, N.W.
Nov. 9, 1881	BLUMFELD, LOUIS, Brauneck, Prince Arthur Road, Hampstead, N.W
Nov. 9, 1881	BOULTING, WILLIAM, L.R.C.P., 1, The Mount, Hampstead, N.W.
Jan. 10, 1883	CASSON, ARTHUR, 2, The Mount, Hampstead, N.W.
Feb. 14, 1883	CLAUDET, ARTHUR C., A.R.S.M., 10, Oak Hill Park, Hampstead, N.W.
May 10, 1883	COOPER, DR. HERBERT, Rosslyn Terrace, Hampstead, N W.
Jan. 16, 1884	COLLETT, WALTER, Woodbrook, Netherhall Terrace, Hampstead, N.W.
Nov. 14, 1883	COWELL, ALBERT, St. Anne's Cottage, Rosslyn Hill, Hampstead, N.W.
Nov. 9, 1881	DAWSON, HUBERT, The Mount, Hampstead, N.W.
July 4, 1880	DURHAM, A. ELLIS, 82, Brook Street, Grosvenor Square, W.

Date of Election.	
July 4, 1880 .	. Ellis, Roland (*Curator*), The Avenue, North End, Hampstead, N.W.
Nov. 8, 1882 .	. Gordon, R. M., 50, South Hill Park, Hampstead, N.W.
Oct. 12, 1881	. Gordon, Thomas H., B.A., 9, The Crescent, Dukinfield, Cheshire.
Dec. 15, 1882	. Granville, O. B., 26, Downshire Hill, Hampstead, N.W.
Sept. 25, 1880	. Haines, F. H., 184, Haverstock Hill, and Edenbridge, Kent.
Nov. 14, 1883	. Hahnemann, L. Süss, M.D., 25, Duncan Terrace, Islington, N.
Nov. 14, 1883	. Hahnemann, L. S. B., 25, Duncan Terrace, Islington, N.
Nov. 14, 1883	. Hill, H. Percy, Ivy Bank, Haverstock Hill, N.W.
Dec. 12, 1883	. Hornibrook, W., Mount Vernon, Hampstead, N.W.
June 11, 1881	. Hoskyn, D. T., 1, Birchington Road, Kilburn, N.W.
Feb. 12, 1881	. Howard, Frederic G., 107, Priory Road, West Hampstead, N.W.
Jan. 11, 1882	. Howard, Frank G., Oaklands, Cricklewood, N.W.
April 8, 1884	. Howard, Daniel, 60, Belsize Park, N.W.
Mar. 14, 1883	. Hunt, Walter Leigh, Lyndhurst Road, Hampstead, N.W.
June 15, 1882	. Keys, T. R., High Street, Hampstead, N.W.
Nov. 14, 1883	. Kirkman, Rev. Joshua, M.A., 4, Thurlow Road, Hampstead, N.W.
Nov. 14, 1883	. Matheson, F. C., Beechworth, Hampstead Heath, N.W.
Nov. 13, 1880	. Moir, Macrae, 2, Willoughby Road, Hampstead, N.W.
Nov. 14, 1883	. Neale, Richard, M.D., 60, Boundary Road, South Hampstead, N.W.
May 10, 1883	. Palmer, W. J., Carluel, Carlingford Road, Hampstead, N.W.
Nov. 8, 1882 .	. Phillips, J. W., Percy House, North End, Hampstead, N.W.
Feb. 8, 1882 .	. Pidcock, G. Douglas, M.B., B.A. (*Vice-President*), Winsborough House, Downshire Hill, Hampstead, N.W.
Oct. 12, 1881	. Rudler, F. W., F.G.S., (*Vice-President,*) 6, Regent's Park Villas, Gloucester Gate, N.W.
July 12, 1883	. Stamp, E. B., 29, High Street, Hampstead, N.W.
June 11, 1881	. Stuart, C. E., B.Sc., 23, Clayton Park Road, Newcastle-on-Tyne.

Date of Election.	
Nov. 8, 1882.	. Stuart, John Edward, Fairview, Arkwright Road, Hampstead, N.W.
Nov. 8, 1882.	. Thompson, Wilfred, 27, Church Row, Hampstead.
April 8, 1884	. Vizard, P. E., Fernlea, Ellerdale Road, Hampstead, N.W.
July 10, 1880	. Watkins, A. L., Rosemont, Greenhill Road, Hampstead, N.W.
July 10, 1880	. Watkins, Charles A. (*President*), Rosemont, Greenhill Road, Hampstead, N.W.
July 4, 1880.	. Watkins, C. H. (*Hon. Secretary and Treasurer*), Rosemont, Greenhill Road, Hampstead, N.W.
July 4, 1880.	. Watkins, Fred. L., Rosemont, Greenhill Road, Hampstead, N.W.
Dec. 15, 1882	. Welton, William S., The Limes, North End, Hampstead, N.W.
Dec. 15, 1882	. Welton, William P., The Limes, North End, Hampstead, N.W.
Oct. 10, 1883	. Wellings, John, 5, Willoughby Road, Hampstead, N.W.
April 8, 1884	. Whitehorn, T., 18, Heath Street, Hampstead, N.W.

Hampstead Naturalists' Club.

RULES.

1. That the Club be called the HAMPSTEAD NATURALISTS' CLUB.

2. That the objects of the Club be to facilitate the study of Natural History—

(*a*) By holding Meetings at which Papers on subjects of Natural History may be read and discussed.

(*b*) By making Excursions.

(*c*) By forming and maintaining a Museum and Library.

(*d*) By publishing Proceedings.

3. That the Club consist of Ordinary and Honorary Members. Ladies to be eligible for election. All Members to have the right of introducing two friends to the Ordinary Meetings, Excursions, and Museum, and of receiving a copy of these Rules. Honorary Members shall not vote at elections.

4. That application for Membership be made through the introduction of one or more Members of the Club, who shall sign a certificate in recommendation of such Candidate, stating his or her name and address, which shall be read by the Secretary at the Ordinary Meeting following the receipt of such Certificate. The election of Members shall be by Ballot, and take place at the ensuing Ordinary Meeting of not less than ten Members (one black ball in five to exclude).

5. That the election of Honorary Members take place at the Annual General Meeting of the Club through the recommendation of the Committee, but the number of Honorary Members shall not exceed twenty.

6. That the Annual Subscription be 10s. (payable to the Treasurer), and become due on the 1st day of April. The Subscriptions of Members elected after that month shall become due on the first quarter-day after election, when they shall pay a *pro rata* subscription for the current year.

7. That any Member whose Subscription is twelve months in arrear shall not be entitled to any of the privileges of the Club, and if two years in arrear shall be excluded from the Club by the General Committee.

8. That the affairs of the Club be managed by a General Committee, consisting of a President, two Vice-Presidents, a Hon. Secretary, Hon. Treasurer, Hon. Curator and Librarian, and five elected Members—five to form a quorum—who shall be elected annually, and be eligible for re-election.

9. That an Ordinary Meeting of the Club be held on the second Wednesday in each month, except July, August, and September, at eight o'clock in the evening, or such other day and time as the Committee may deem fit, and that the Secretary give seven days' notice to every Member of the time, date, and business of each Meeting.

10. That the Annual General Meeting be held as early in April as the Committee can arrange, when the Officers for the ensuing year shall be elected, and the Balance-Sheet and the Report of the Committee read. Notice to be given as in Rule 9.

11. That at the request of the Committee, or on receipt of a requisition signed by any eight Members of the Club, the Secretary shall within ten days call a Special General Meeting at a convenient place in Hampstead stated on the requisition. The Secretary shall give the Members seven clear days' notice of such Meeting and the purpose for which it is called. Fifteen members to form a quorum.

12. That no alteration be made in the Rules of the Club except at the Annual General Meeting, and all proposals of alteration to be sent to the Secretary five weeks before the

Meeting, of which he shall give four weeks' notice to every Member.

13. That the Curator have charge of the Club Collection and Library, and keep a classified list of the specimens and books contained therein, which shall be open for the inspection of Members.

14. That the Treasurer keep an account of all moneys paid to and by him and balance the accounts half yearly.

15. That two Members of the Club be elected Auditors, who shall audit the accounts of the Treasurer and report on them at the Annual General Meeting.

16. That all donations to the Museum be sent to the Curator, and announced by the Secretary at the next Ordinary Meeting.

17. That no live specimen be received by the Club.

18. That all duplicate specimens be at the disposal of the Committee.

LIST OF BOTANICAL SPECIES

OBSERVED IN THE DISTRICT BY MR. ROLAND ELLIS.

Date when first observed in flower.	Species.
Jan. 25.	Ulex europaeus (Furze).
Feb. 10.	Alnus glutinosus (Alder).
,, 17.	Stellaria media (Chickweed).
Mar. 20.	Tussilago farfara (Coltsfoot).
April 7.	Salix repens (Creeping Sallow) ♂ and ♀.
,,	Anemone nemorosa (Wood Anemone).
,,	Potentilla fragriarastrum (False Strawberry).
,,	Caltha palustris (Marsh Marigold).
,,	Ranunculus ficaria (Lesser Celandine).
8.	Nepeta glechoma (Ground Ivy).
,,	Taraxacum densleonis (Dandelion).
,,	Salix caprea (Sallow) ♂.
25.	Stellaria holostea (Starwort).
28.	Cardamine pratensis (Bittercress).
29.	Luzula campestris (Field Woodrush).
,,	Betula alba (Birch) ♂ and ♀.
May 1.	Prunus communis (Sloe).
3.	Scilla nutans (Bluebell).
,,	Viola canina (Dog Violet).
,,	Capsella bursa-pastoris (Shepherds' purse).
15.	Prunus cerasus (Wild Cherry).
17.	Ranunculus aquatilis (Water Crowfoot).
,,	Ranunculus hederaceus (Ivy Ranunculus).

Date when first observed in flower.	Species.
May 3.	Pyrus malis (Wild Apple).
,,	Genista anglica (Petty Whin).
,,	Lamium purpureum (Red Dead-nettle).
,,	Viola palustris (Marsh Violet).
20.	Sorothamus scoparius (Broom).
,,	Ajuga reptans (Bugle).
,,	Veronica chamaedrys (Birds'-eye).
,,	Tormentilla reptans (Creeping Tormentilla).
26.	Acer pseudo-platanus (Sycamore).
,,	Crataegus oxyacantha (May).
June 1.	Menyanthes trifoliata (Buckbean).
,,	Lychnis diurna (Campion).
,,	Lychnis flos-cuculi (Ragged Robin).
,,	Chrysanthemum leucanthemum (Oxeye Daisy).
8.	Rubus caesius (Dewberry.
10.	Galium saxatile (Heath Bedstraw).
,,	Galium uliginosum (Marsh Bedstraw).
,,	Veronica beccabunga (Brooklime).
,,	Lysimachia nummularia (Creeping Jenny).
,,	Sambucus nigra (Elder).
,,	Rubus fruticosus (sevl. varieties) Blackberry.

Date when first observed in flower.	Species.
June 10.	Nasturtium officinale (Watercress).
13.	Pedicularis sylvatica (Lousewort).
,,	Veronica officinalis (Common Veronica).
16.	Sedum acre (Yellow Stonecrop).
17.	Silene inflata (Bladder Campion).
,,	Lathyrus pratensis (Meadow Vetch).
,,	Solanum dulcamara (Nightshade).
,,	Pyrus torminalis (Service tree).
25.	Lapsana communis (Nipplewort).
,,	Rosa arvensis (Field-rose).
,,	Centaurea cyanea (Corn Bluebottle).
,,	Rumex acetosa (Sorrel).
,,	Rumex acetosella(Sheep Sorrel).
July 1.	Bryonia dioica (Bryony).
,,	Ranunculus lingua (Spearwort).
,,	Hydrocotile vulgaris (Marsh Pennywort).
,,	Rubus idaeus (Raspberry).
,,	Prunella vulgaris (Self-heal).
,,	Plantago coronopus (Buckshorn).
,,	Matricaria camomilla (Camomile).
5.	Achillea milifolium (Milfoil).
8.	Teucrium scorodonia (Wild Sage).
,,	Tilia europea (Lime).
14.	Lotus corniculatus (Birds'-foot Trefoil).
,,	Erica cincrea (Scotch Heather).

Date when first observed in flower.	Species.
July 14.	Erica tetralix (Cross-leaved Heather).
,,	Stellaria graminea (Lesser Starwort).
,,	Vaccinium myrtillus (Bilberry) Fruit.
15.	Rhamnus frangula (Alder Buckthorn fl. and fr).
,,	Spergularia rubra (Sandspurry).
,,	Mentha aquatica (Water Mint).
,,	Centaurea nigra (Knapweed).
,,	Senecio jacobea (Ragwort).
,,	Stachys betonica (Betony).
,, 29	Carduus arvensis (Creeping Thistle).
Aug. 1.	Gnaphalium uliginosum (Marsh Cudweed).
4.	Spirea ulmaria (Meadow-sweet).
,,	Myosotis arvensis (Field Myosote).
,,	Vicia cracca (Tufted Vetch).
,,	Ononis arvensis (Rest-harrow).
5.	Juncus articulatus (Jointed Rush).
9.	Convolvulus arvensis (Great Bindweed).
,,	Erica vulgaris (Common Heather).
Sep. 18.	Bidens cernua (Bur Marigold).
23.	Spergula arvensis (Corn Spurry).
,,	Alisma plantago (Great Water Plantain).
,,	Scabiosa arvensis (Devils'-bit.)
Oct. 28.	Hedera halix (Ivy).
,,	Ulex europaeus (Furze) autumn flowering commenced.

LIST OF ZOOLOGICAL SPECIES

OBSERVED IN THE DISTRICT BY MESSRS. F. H. HAINES, T. R. KEYS, W. DAWSON, AND OTHERS.

References—(*) means "observed;" (†) means "captured or shot."

Mar. 23. *Swallow (Hirundo rustica) Linn.
30. *Common Bat (Vespertilio pipistrellus), Geoff.
April 29. *Wheatear (Saxicola oenanthe), Linn.
" *Cuckoo (Cuculus canorus).
" *Great Whitethroat (Sylvia rufa) Bodd.
" †Nightingale (Daulias luscinia), Linn.
" *Common Wagtail (Motacilla alba), Linn.
" *Heron (Ardea cinerea).
16. †Barn-owl (Strix flammea) Linn.
25. †Wryneck (Yunx torquilla), Linn. ♀.
" *Willow-wren (Sylvia trochilus), Linn.
May 4. *Redstart (Ruticella phoenicurus).
9. †Sedge-warbler (Salicaria phragmitis) Bech., with nest.
" *Lesser Whitethroat (Sylvia curruca), Linn.
15. *Stonechat (Saxicola rubecula), Linn.
" *Whinchat (S. rubetra) Linn., with nest.
20. *Woodpigeon (Columba palumbus) ♂ and ♀.
26. *Partridge (Perdrix cinera) on nest.
June . †Landrail (Crex pratensis).
July 19. †Lesser Spotted Woodpecker (Picus minor).
Oct. 14. *Jay (Garrulus glandarius).
" †Tree-creeper (Certhia familiaris).
Dec. 2. †Nuthatch (Sitta caesia), Wolf.
24. †Red-backed Shrike (Lanius collurio), ♂ and ♀.
Mar. 13. †Weasel (Mustela vulgaris), Linn.
" †Stoat (M. erminea), Linn.
Nov. . †Dormouse (Myoxus avellanarius), Linn.
May . †Shrew-mouse (Sorex vulgaris), Linn.
" †Short-tailed Field-mouse (Arvicola agrestis), Linn.
June . †Long ditto. (Mus sylvaticus), Linn.
" †Water Shrew (Sorex fodieus), Pall.
" †Mole (Talpa europea), Linn.
" †Water-rat or Vole (Arvicola amphibius), Desm.
May 20. *Serotine (Scotophilus serotinus) Gray.
15. †Common Bat (S. pipistrellus) Bell.
" †Long-eared Bat (Plecotus auritus) Geoff.
" *Helix aspersa.
" *H. Nemoralis.
" †2 var. Planorbis.
" †2 var. Lymnea.
" †Lacerta agilis (Common Lizard).
" †Coluber natrix (Grass Snake).
" †Anguis fragilis (Blind-worm).

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