

## **Notes on zoological museums / by J.E. Gray.**

### **Contributors**

Gray, John Edward, 1800-1875.  
Royal College of Surgeons of England

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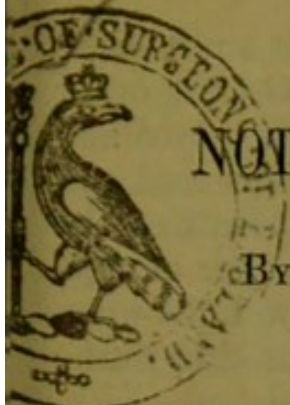
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Wellcome Collection  
183 Euston Road  
London NW1 2BE UK  
T +44 (0)20 7611 8722  
E [library@wellcomecollection.org](mailto:library@wellcomecollection.org)  
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from the Author



## NOTES ON ZOOLOGICAL MUSEUMS.

BY DR. J. E. GRAY, F.R.S., V.P.Z.S., &c.

### I. *The President's Address at the Opening of the Natural History Section of the British Association at Bath, 1864.*

I SHOULD wish to say a few words on the subject of Public Museums. It may be imagined that, having the whole of my life been intimately connected with the management of what I believe to be at the present day the most important zoological museum in the world, it is a subject that has long and deeply occupied my thoughts; and it will also be readily believed that it is only after serious and prolonged consideration I have come to the conclusion that the plan hitherto pursued in their arrangement has rendered them less useful to science and less interesting to the public at large than they might have been made under a different system. Let us consider the purposes for which such a museum is established.

These are two: 1st, the diffusion of instruction and rational amusement among the mass of the people; and 2nd, to afford the scientific student every possible means of examining and studying the specimens of which the museum consists. Now it appears to me that, in the desire to combine these two objects, which are essentially distinct, the first object, namely the general instruction of the people, has been to a great extent lost sight of and sacrificed to the second, without any corresponding advantage to the latter, because the system itself has been thoroughly erroneous. The curators of large museums have naturally, and, perhaps, properly, been men more deeply devoted to scientific study than interested in elementary instruction, and they have consequently done what they thought best for the promotion of science by accumulating and exhibiting on the shelves or in the open cases of the museum every specimen which they possess, without considering that by so doing they were overwhelming the general visitor with a mass of unintelligible objects, and at the same time rendering their attentive study by the man of science more difficult and onerous than if they had been brought into a smaller space and in a more available condition.

What the largest class of visitors, the general public, want is a collection of the more interesting objects so arranged as to

afford the greatest possible amount of information in a moderate space, and to be obtained, as it were, at a glance. On the other hand, the scientific student requires to have under his eyes and in his hands the most complete collection of specimens that can be brought together, and in such a condition as to admit of the most minute examination of their differences, whether of age, or sex, or state, or of whatever kind that can throw light upon all the innumerable questions that are continually arising in the progress of thought and opinion.

Every scientific student requires the cases to be opened, to allow him to examine and handle the specimens, and in the stuffed state this cannot be often done without injury; and an artist always requires them to be taken out of the case for his purpose.

In the futile attempt to combine these two purposes in one consecutive arrangement, the modern museum entirely fails in both particulars. It is only to be compared to a large store or a city warehouse, in which every specimen that can be collected is arranged in its proper case and on its proper shelf, so that it may be found when wanted; but the uninformed mind derives little instruction from the contemplation of its stores, while the student of nature requires a far more careful examination of them than is possible under such a system of arrangement, to derive any advantage; the visitor needs to be as well informed with relation to the system on which it is based as the curator himself; and consequently the general visitor perceives little else than a chaos of specimens, of which the bulk of those placed in close proximity are so nearly alike that he can scarcely perceive any difference between them, even supposing them to be placed on a level with the eye, while the greater number of those which are above or below this level are utterly unintelligible.

To such a visitor, the numerous species of rats, or squirrels, or sparrows, or larks that crowd the shelves, from all parts of the world, are but a rat, a squirrel, a sparrow, or a lark; and this is still more especially the case with animals of a less marked and less known type of character. Experience has long since convinced me that such a collection so arranged is a great mistake; the eye, both of the general visitor and of the student, becomes confused by the number of the specimens, however systematically they may be brought together.

The very extent of the collection renders it difficult even for the student, and much more so for the less scientific visitor, to discover any particular specimen of which he is in quest; and the larger the collection, the greater this difficulty becomes. Add to this the fact that all specimens, but more especially the more beautiful and the more delicate, are speedily deteriorated,

and in some cases destroyed for all useful purposes, by exposure to light, and that both the skins and bones of animals are found to be much more susceptible of measurement and comparison in an unstuffed or unmounted state, and it will be at once apparent why almost all scientific zoologists have adopted for their own collections the simpler and more advantageous plan of keeping their specimens in boxes or in drawers, devoted each to a family, a genus, or a section of a genus, as each individual case may require.

Thus preserved and thus arranged, the most perfect and the most useful collection that the student could desire would occupy comparatively a small space, and by no means require large and lofty halls for its reception. As it is desirable that each large group should be kept in a separate room, and as wall space is what is chiefly required for the reception of the drawers or boxes, rooms like those of an ordinary dwelling-house would be best fitted for the accommodation of such a collection and of the students by whom it would be consulted—one great advantage of this plan being that students would be uninterrupted by the ignorant curiosity of the ruder class of general visitors, and not liable to interference from scientific rivals.

There are other considerations also which should be taken into account in estimating the advantages of a collection thus preserved and thus arranged. A particular value is attached to such specimens as have been studied and described by zoologists, as affording the certain means of identifying the animals on which their observations were made. Such specimens ought especially to be preserved in such a way as to be least liable to injury from exposure to light, dust, or other extraneous causes of deterioration; and this is best done by keeping them in a state least exposed to these destructive influences, instead of in the open cases of a public and necessarily strongly lighted gallery. This is particularly the case with animals, or parts of animals, preserved in spirits, which ought to be kept in dark closets, or cases with opaque fronts, in cool rooms, as the light very soon destroys their colour, and the light and warmth cause the spirits to rapidly evaporate.

In imitating the French plan, the fact was overlooked that the French, and most continental collections, are especially made for the use of scientific students, the pupils of the Professor, and not, as our National and local collections are, for the use of the public at large, including the students, who form a very small part of the visitors.

Again, the amount of saving thus effected in the cost of stuffing and mounting is well worthy of serious consideration, especially when we take into account that this stuffing and

mounting, however agreeable to the eye, is made at the cost of rendering the specimens thus operated upon less available for scientific use.

All these arguments go to prove that, for the purposes of scientific study, the most complete collection that could possibly be formed would be best kept in cabinets or boxes from which light and dust would be excluded, in rooms especially devoted to the purpose, and not in galleries open to the general public, and that such an arrangement would combine the greatest advantage to the student and the most complete preservation of the specimens with great economy of expense.

This being done, it is easy to devise the plan of a museum which shall be the most interesting and instructive to general visitors, and one from which, however short may be their stay, or however casual their inspection, they can hardly fail to carry away some amount of valuable information.

The larger animals, being of course more generally interesting, and easily seen and recognized, should be exhibited in the preserved state, and in situations where they can be completely isolated. This is necessary also on account of their size, which would not admit of their being grouped in the manner which I propose with reference to the smaller specimens.

The older museums were for the most part made up of a number of the square glass-fronted boxes, each containing one, or sometimes a pair of specimens. This method had some advantages, but many inconveniences—among others, that of occupying too large an amount of room. But I cannot help thinking that when this was given up for the French plan of attaching each specimen to a separate stand, and marshalling them like soldiers on the shelves of a large open case, the improvement was not so great as many suppose; and this has become more and more evident since the researches of travellers and collectors have so largely increased the number of known species, and of species frequently separated by characters so minute as not to be detected without careful and close examination.

Having come to the conclusion that a museum for the use of the general public should consist chiefly of the best-known, the most marked, and the most interesting animals, arranged in such a way as to convey the greatest amount of instruction in the shortest and most direct manner, and so exhibited as to be seen without confusion, I am very much disposed to recur to something like the old plan of arranging each species or series of species in a special case, to be placed either on shelves or tables, or in wall cases, as may be found most appropriate, or as the special purpose for which each case is prepared and exhibited may seem to require.

But instead of each case, as of old, containing only a single specimen, it should embrace a series of specimens, selected and arranged so as to present a special object for study; and thus any visitor, looking at a single case only, and taking the trouble to understand it, would carry away a distinct portion of knowledge, such as, in the present state of our arrangements, could only be obtained by the examination and comparison of specimens distributed through distant parts of the collection.

Every case should be distinctly labelled with an account of the purpose for which it is prepared and exhibited; and each specimen contained in it should also bear a label indicating why it is there placed.

I may be asked, why should each series of specimens be contained in a separate case? but I think it must be obvious that a series of objects exhibited for a definite purpose should be brought into close proximity, and contained in a well-defined space; and this will best be done by keeping them in a single and separate case. There is also the additional advantage that whenever, in the progress of discovery, it becomes desirable that the facts for the illustration of which the case was prepared should be exhibited in a different manner, this can easily be done by rearranging the individual case without interfering with the general arrangement of the collection. I believe that the more clearly the object is defined and the illustrations kept together, the greater will be the amount of information derived from it by the visitor and the interest he will feel in examining it.

Such cases may be advantageously prepared to show—

The classes of the animal kingdom.

The orders of each class.

The families of each order.

The genera of each family.

The sections of each genus, by means of one or more typical or characteristic examples of each class, order, or section.

A selection of a specimen of each of the more important or striking species of each genus or section.

The changes of state, sexes, habits, and manners of a well-known or an otherwise interesting species.

The economic uses to which they are applied; and such other particulars as the judgment and talent of the curator would select as best adapted for popular instruction, and of which these are only intended as partial indications.

No one, I think, who has ever had charge of a museum, or has noted the behaviour of the visitors while passing through it, can doubt for a moment that such cases would be infinitely more attractive to the public at large than the crowded shelves of our present museums, in which they speedily become bewil-

dered by the multiplicity, the apparent sameness, and at the same time the infinite variety of the objects presented to their view, and in regard to which the labels on the tops of the cases afford them little assistance, while those on the specimens themselves are almost unintelligible.

When such visitors really take any interest in the exhibition, it will generally be found that they concentrate their attention on individual objects, while others affect to do the same, in order to conceal their total want of interest, of which they somehow feel ashamed, although it originates in no fault of their own.

I think the time is approaching when a great change will be made in the arrangement of Museums of Natural History, and have therefore thrown out these observations as suggestions by which it appears to me that their usefulness may be greatly extended.

In England, as we are well aware, all changes are well considered and slowly adopted. Some forty years ago, the plan of placing every specimen on a separate stand, and arranging them in rank and file in large glass wall cases, was considered a step in advance, and it was doubtless an improvement on the preexisting plan, especially at a time when our collections were limited to a small number of species, which were scarcely more than types of our modern families or genera.

The idea had arisen that the English collections were smaller than those on the Continent, and the public called for every specimen to be exhibited. But the result has been that, in consequence of the enormous development of our collections, the attention of the great mass of visitors is distracted by the multitude of specimens, while the minute characters by which naturalists distinguish genera and species are inappreciable to their eyes.

It was not, however, the unenlightened public only who insisted on this unlimited display; there were also some leading scientific men who called for it, on the ground that the curator might be induced to keep specimens out of sight in order to make use of them for the enlargement of his own scientific reputation, while the scientific public were debarred the sight of them, and that valuable specimens might thus be kept, as the favourite phrase was, "in the cellars." But any such imputation would be completely nullified by the plan which I have proposed of placing all the specimens in the scientific collection in boxes or drawers appropriated to them, and rendering them thus at once and readily accessible to students at large.

I may observe that the late Mr. Swainson, who was the first to raise the cry, lived to find that it was far more useful to

keep his own extensive collection of bird-skins in drawers, like his butterflies and his shells; and that most scientific zoologists and osteologists are now convinced that the skins of animals unmounted and kept in boxes are far more useful for scientific purposes than stuffed skins or set-up skeletons.

So also, with reference to my proposal for the arrangement of the Museum for the general public, I find that those who are desirous of exhibiting their specimens to the best advantage are generally adopting similar plans.

Thus, when Mr. Gould determined on the exhibition of his magnificent collection of Humming-birds, he at once renounced the rank-and-file system, and arranged them in small glazed cases, each case containing a genus, and each pane or side of the case showing a small series of allied species, or a family group of a single species.

When lately at Liverpool, I observed that the clever curator, Mr. Moore, instead of keeping a single animal on each stand, has commenced grouping the various specimens of the same species of Mammalia together on one and the same stand, as several are grouped in the British Museum, and thus giving far greater interest to the group than the individual specimens would afford.

In the British Museum, as an experiment with the view of testing the feelings of the public and the scientific visitors, the species of Nestor Parrots and of the Birds of Paradise, a family of Gorillas and the Impeyan Pheasants, and sundry of the more interesting single specimens, have been placed in isolated cases; and it may readily be seen that they have proved the most attractive cases in the exhibition. A series of reptiles and fish, exhibiting the characters of the families and the more interesting genera, have been stuffed and exhibited, whilst the collection of those animals in spirits and in skins is kept arranged for the use of the more scientific student.

In the same manner, a series of the skeletons, showing the principal forms of each class of animals, has been set up, and the remainder of them kept in boxes, so that a series of the same bone of any number of animals may be laid out for comparison with either recent or fossil specimens, or to show the form the bone assumes in the different genera, which it is difficult to see in an articulated skeleton.

In the Great Exhibition of 1862, Professor Hyrtl of Vienna exhibited some framed cases of skeletons like those here recommended: one contained the types of each family of Tortoises, another the principal forms of Saurians, &c. They excited much interest, and some cases were purchased by our College of Surgeons.



In some of the continental museums also I have observed the same plan adopted to a limited extent.

I now exhibit a case of insects, received from Germany, in which what I have suggested is fully carried out. You will perceive that in one small case are exhibited simultaneously, and visible at a glance, the egg, the larva, the plant on which it feeds, the pupa, and the perfect moth, together with its varieties and the parasites by which the caterpillar is infested. Such cases, representing the entire life and habits of all the best-known and most interesting of our native insects, would be, as I conceive, far more attractive and instructive to the public at large than the exhibition of any conceivable number of rows of allied or cognate species, having no interest whatever except for the advanced zoological student.

I will only add that I am perfectly satisfied, from observation and experience, and that I believe the opinion is rapidly gaining ground, that the scientific student would find a collection solely devoted to the object of study, and preserved in boxes and drawers, far more useful and available for scientific purposes than the stuffed specimens as at present arranged in galleries of immense extent, and crowded with curious and bewildered spectators; while, on the other hand, the general public would infinitely better understand, and consequently more justly appreciate, a well-chosen and well-exhibited selection of a limited number of specimens, carefully arranged to exhibit special objects of general interest, and to afford a complete series for elementary instruction, than miles of glass cases containing thousands upon thousands of specimens, all exhibited in a uniform manner, and placed like soldiers at a review.

The plan has the advantage of being as applicable to a very large as to a small local collection, for a few well-selected cases of animals of any parish or district will teach what they have been prepared to illustrate, and the addition of every well-selected series of specimens will extend the usefulness of the institution, and the better the animals are known to the visitor the more is the interest they will take in the exhibition.

Specimens are much less liable to injury (and this is a great consideration in a small institution, where only a single curator, often an unpaid amateur, is employed) if they are kept in small well-closed cases, properly pasted up, than if they are kept in large cases that open, where the air changes with every change of temperature; for the air is expelled when the cases are warm, and it rushes in again, charged with dust and destructive gases, when the air within is cool and contracted.

*Note.*—Professor Agassiz, Director of the Museum of Comparative Zoology at Harvard College, in Cambridge, Massachusetts,

in his remarkable Annual Report to the Trustees for 1864, observes, "I regret the more any delay in that respect, since I see that the directors of other museums begin to feel the imperfections of the present arrangements of their collections, and are proposing as new schemes identical with those which for many years have been in active operation with us. I would particularly refer to the recent suggestions of Dr. J. E. Gray, published in a recent number of the 'Annals and Magazine of Natural History,' the burden of which coincides, though on a limited scale, with what we have long been doing upon a much more extended plan for several years past" (p. 13).

## II. *Suggestions and Recommendations, Feb. 1868.*

If the Zoological Department, instead of attempting as hitherto to exhibit a series of specimens of every species of the animal kingdom, were to adopt the plan followed in the other departments of exhibiting to the public and the younger students a series of only the more interesting and instructive specimens, keeping the remainder of the collection in rooms devoted to the purpose, and arranged in a manner which would be far more useful to the advanced student, the exhibition rooms which are now devoted to the Zoological Department would be amply sufficient for the purpose.

If galleries were erected above the wall cases in the public rooms now occupied by the Zoological Collection, like those over the book-cases in the Library (as was proposed when the rooms were first fitted up, but then temporarily delayed), and the walls of those galleries fitted with presses, the collection of animals preserved in spirits and most of the bones of vertebrated animals now in the basement might be arranged in these presses in a manner easily accessible to and usefully available for students. As animals preserved in spirits cannot be shown in glass cases and exposed to the light without immediate deterioration and irremediable injury, such presses would afford the best situation and protection that could be given to this part of the collection.

The chief want of the Department of Zoology is better and more convenient rooms for study; but there is no reason why these should be placed in that part of the Museum which is built and fitted at great cost for public exhibition. The present mode of exhibiting, in the Zoological Department, as many specimens as possible was adopted more than thirty years ago, when the collection began to increase largely in extent; but since that period zoologists have found the great advantage of keeping their own collections in an unstuffed state and in drawers or boxes, as being far more convenient for examination

and comparison. All our leading ornithologists, as Gould, Sclater, and Salvin, and all entomologists and conchologists, have now adopted the plan of so keeping them ; and the advantage is so obvious that it is most desirable that the Museum should adopt a similar plan.

Dr. Gray is satisfied that an exhibition of the larger animals and of a selected series of the smaller species, for the purpose of showing the characters of the families and genera, and of such species as are most striking from the beauty of their form or colour, or interesting from their habits and economical uses, would be far more interesting and instructive to the public than that of the most complete series that could be formed, inasmuch as the enormous number and general similarity of multitudes of nearly allied species have the effect rather of confusing than enlightening the minds of the generality of visitors.

On the other hand, the keeping as complete a series of species as can possibly be formed in cabinets or boxes would produce a collection far more useful and available to students, inasmuch as the specimens are thus preserved in a better state for study, can be more closely examined, and are protected from the injurious effects of light and dust, which rapidly destroy their characters and deteriorate their condition.

Dr. Gray would observe that this plan of exhibiting only a limited number of the most interesting articles is followed in the Departments of Printed Books, Manuscripts, Prints, and Botany. Indeed the same principle may be said to be applied in the reading-room, where the readers have free access to, and make large use of, an admirably selected library of books of general interest in each department of literature ; while the whole collection of Sculptures and Antiquities generally can only be regarded as an exhibition of selected objects. The same plan of select exhibition has been adopted and excellently carried out by the present Curator of the Museum of the Royal College of Surgeons, and also in the Museum of Practical Geology in Jermyn Street ; and it is the plan followed in the larger museums of the United States under the direction of Professor Agassiz.

Dr. Gray cannot conclude this Report without reiterating his firm conviction of the paramount importance of retaining the Zoological Collection in its present central situation. Zoology, in its various branches, is the especial study and relaxation of the middle and of the more intellectual of the working classes ; the study of animals can be cultivated by means of specimens either collected by themselves or procurable at so small a cost as to come within their limited means. It does not require for its pursuit the classical, historical, and artistic education, nor

the well-filled purse and the large rooms which are necessary for those who would collect and appreciate antiquities and works of art. To these classes the collection is becoming daily more and more important, as there is every sign that more and more attention will be henceforth paid to their technical and scientific education. Placed as it is, the British Museum is in the centre of the capital, surrounded by the colleges and hospitals in which natural history is taught, and from which the pupils continually come to study its collections; under such circumstances it is certain to become more and more important an educational institution, and one in which the beauties and the wonders of Creation can be best and most conveniently studied. All these advantages would be utterly lost if the Natural History Departments were to be removed to the outskirts of the town.

As evidence of the small comparative cost of zoological specimens, and consequently of the facility of acquisition, which renders them so favourite a study with the people at large, Dr. Gray may state that he believes the very large number of specimens (upwards of a million) which have been acquired by the Zoological Department during the forty-four years in which he has been in the employment of the Trustees have been obtained at a cost not exceeding one shilling per specimen. At this small average cost, and under the fostering care of the Trustees, there has been formed, for the moderate sum of about £50,000, what is universally allowed to be the largest, most complete, and most easily accessible zoological museum in the world, open without restriction to students of all nations, and by them rendered most largely available. Such a collection, so ample and so useful, could not be moved without closing it for a considerable time to public use, which would in itself be a serious deprivation to the public and a grievous injury to the progress of science.

Feb. 21, 1868.

MY DEAR SIR,

In conformity with your letter of the 12th of Feb. 1868, I yesterday had a conference with Mr. Alfred Waterhouse, on the portion of the proposed new building that is to be used for the zoological collections.

I herewith enclose a copy of the suggestions which I made, and which, after the conference, I sent to Mr. A. Waterhouse that he might refer to it at his leisure. Mr. A. Waterhouse has promised to repeat his visit, and I shall gladly give him any further exposition of my views that he may think will be of use to him, and also particulars respecting the internal fitting of the exhibition rooms and studios; for I consider that, if the

Government is going to expend so large a sum (nearly half a million) on the erection of a Natural History Museum, the question should be carefully considered in all its bearings.

If an average space and series of exhibition rooms sufficiently large to contain a well-selected series of all the animals most interesting to the public and the junior student are erected, that will be all that can be required for a very considerable period. Should any new fashion of exhibition or particular kind of study arise, it will only be required to remove some of the specimens and supply their places by species illustrative of the newer method of study or preparation.

The discovery of new animals, and of improved methods of study of animals in general, will only require increased space in the room set apart for the collection devoted to study; and I believe that the space proposed for that purpose, though not more than is now required, will also afford all the space that can be requisite for the next thirty or even fifty years; and should new rooms of this kind be required, they can be easily (unlike the exhibition rooms) added without deranging the general plan of the building.

*The Principal Librarian, &c. &c.*

1. *The part of the Collections exhibited in the SALOON open to the Public.*

The Mammalia and their skeletons, being of a large size, require to have good-sized rooms.

The birds and other animals, being small, are better seen in moderate-sized rooms, as large rooms dwarf the size of the specimens.

The rooms and the cases in them need not be alike, as that tires the eyes of the visitors.

Too much and too brilliant ornamentation of the rooms and cases kill the specimens; but, at the same time, they need not be like the rooms of a "dock warehouse."

The rooms should be lighted so that the specimens shown can be seen in the dark winter weather; but the lights should be easily under control by blinds or other means, as excess of light, especially of direct sunlight, even through blinds, is a very great evil in a museum, as it destroys the colour, texture, and otherwise injures the specimens.

Lantern-lights are better than skylights, as they are more under control, and ventilation is more easily arranged by them. Slanting skylights are rarely watertight, and if they are, in damp weather, the moisture condenses on the inside of them, and drops on the cases or specimens.

The wall cases should all be on the floor. Galleries are very well as makeshifts where ground is scarce or not to be had. Galleries are always inconvenient if they are used for a part of the collection open to the public. Their use also prevents the museum from having sufficient floor space for table cases, which show many kinds of specimens much more conveniently than wall cases; indeed there are some specimens that cannot be shown except in table cases.

The table cases at present in use are of two forms, the greater part of them being double cases, that is, two small table cases united together; they measure  $4\frac{1}{2}$  feet by  $7\frac{1}{4}$  feet. The others are used for the Corals, and have an upright case above, between the table part of the cases; they are 4 feet by  $6\frac{1}{2}$  feet.

More table cases will be wanted; they might be of a rather different form, to introduce variety.

If the skeletons of whales are exhibited, they are much better seen when placed in the middle of a room, or raised only slightly above the floor, so that they can be seen by persons walking, or, at most, not raised higher than the skeleton of the Greenland whale now shown at the College of Surgeons. When suspended from the roof, they can only be very imperfectly seen or understood.

The exhibited collections now occupy the following space:—

Mammalia, wall cases . . . . .	1200 feet.
Birds . . . . .	830 „
Reptiles . . . . .	150 „
Fish . . . . .	150 „
British zoology . . . . .	240 „

Bones of vertebrate animals, if exhibited, will require 1000 feet of wall cases and the ground of the rooms.

Shells . . . . .	occupy 50 double table cases, $4\frac{1}{2} \times 7\frac{1}{4}$ .
British zoology . . . . .	8 „ „
Radiated animals . . . . .	12 „ „
Insects and Crustacea . . . . .	12 „ „
Corals . . . . .	16 coral-cases, $4 \times 6\frac{1}{4}$ .

These wall and table cases are the minimum of the space required.

## 2. *The Collection kept for Study.*

This is the most important part of the Museum as regards science.

This collection is most conveniently and usefully kept in moderate-sized rooms, from 20 by 30, or, better, 30 by 50 feet, as that gives about 100 feet wall space, having three good-sized

windows in the wall. Skylights do not suit for the minute and close examination of specimens. North light is the best, as then the collections are not injured, and students are not inconvenienced by the sun.

There should be placed a table in front of each window, one for the person in charge of the room, and the others for the student or students who may be consulting the collection. Book-cases in the vacancy between the windows for the registers, catalogues, and other books, or those boxes and apparatus specially appertaining to the specimens in the room, the cabinets for the collections being arranged on the three sides of the room, and tables in the centre, for the arrangement and exhibition of specimens when wanted for study. These studios should be all near together; those for the insects might more conveniently open into each other. Open fires are the best means of warming and ventilating these rooms; hot air is bad, as drying the specimens.

If there is not a large general library for all the departments of Natural History, there will be required two such rooms for the special library of the Zoological Departments, and two, if not three, as private studies for the officers of the departments.

Rooms and Lavatories for the attendants; two or three large laboratories for the unpacking, sorting, and preservation of the specimens; a carpenter's shop for placing of the specimens on stands &c.; some store-rooms: these may be in the basement.

The collections of specimens for study now in the Museum, in addition to those exhibited in the saloon, occupy the following run of wall cases; it is the minimum space required:—

Mammalia . . . . .	208 feet.
Birds . . . . .	200 „
Fishes and Reptiles . . . . .	475 „
Bones of vertebrate animals . . . . .	500 „
Insects and Crustacea . . . . .	500 „
Mollusca and Radiata . . . . .	100 „

*Note.*—In a letter just received from Professor Lovén, of Stockholm, he observes, “I cannot well conceive your grand collections moved down to Kensington; but if the Natural History Museum is to be placed there, I am sure you will make *it the first museum in the world*. Above all let it be provided with a good number of spacious, airy, and well-lighted working-rooms for all the different departments.”

British Museum, Feb. 27, 1868.

MY DEAR SIR,

As the Trustees have placed the officers of the Natural History Department in communication with the architect who has been directed to prepare plans and models for a new Museum of Natural History, and as it is understood that application is about to be to Parliament to enable the Trustees to separate the collections, I beg to send you the following observations and suggestions connected with that subject, requesting you to bring them before the Trustees for their consideration. It appears to me important that these suggestions should now be made, inasmuch as, if they should be thought worthy of adoption, it would be desirable to ascertain what would be the modifications resulting from them before the plans for the new Museum are finally settled.

I. I am strongly of opinion, and I am confirmed in that opinion by the leading zoologists and palæontologists of the country, that the separation of recent and fossil animals, in distinct departments, is not conducive to the scientific study, either of zoology or palæontology, as at present conducted.

As the study of recent plants is essential to the proper understanding of the fossil flora, so the study of recent and that of fossil zoology are mutually dependent on each other, and can only be advantageously carried on in conjunction; and the more intimately the recent and fossil collections are blended together, the more usefully will the study of both be advanced.

The bones of recent animals cannot be separated from the preserved specimens of the same animals, as the systematic distribution of vertebrates, and the determination of their genera and species, are every day becoming more and more dependent on characters derived from the study of their skeletons; and this increased attention to the study of recent osteology greatly facilitates the determination of the fossil remains of Vertebrata, while the study of the latter would be materially advanced by having the fossil species arranged side by side with the recent. The same is true with regard to the recent and fossil Mollusca, Articulata, and Radiata.

I beg that it may be distinctly understood that in making these suggestions, which are in strict conformity with the present state of natural science, and with the opinions of its most distinguished professors, I have not the smallest desire of adding to the extent or importance of that portion of the Natural History Collections which is under my own especial care. Should they meet with acceptance on the part of the Trustees, I am quite ready to accept the keepership of either of the Departments into which the present Department of Zoology



may be subdivided, and resign the remainder as may be thought desirable. Of course I do not propose that this should be done immediately, or under present circumstances; but it appears to me that if the collections are removed, the opportunity of carrying out so desirable a separation should be seized and made use of.

With a view to the carrying out of these suggestions, which I believe to be the most important to the progress of science, I would propose that the collection of recent and fossil animals should be distributed into three Departments:—

1. The Department of Vertebrated Animals, containing the Mammalia, Birds, Reptiles, and Fishes, and the recent and fossil bones of these animals.
2. The Department of Articulated Animals, containing the Insects, Crustacea, and Arachnida, recent and fossil.
3. The Department of Molluscous and Radiated Animals, containing the Mollusca and their Shells, and the Radiata and their Skeletons, recent and fossil.

I may add that the study of animals is divided into several distinct departments in most of the large continental Museums, and that in some, as in that of Paris, the Vertebrata form two Departments, one for Mammalia and Birds, and the other for Reptiles and Fishes.

II. Whenever the Zoological Collection is removed to another building, it will be necessary that the scientific staff should be very considerably increased, not only during the removal, but also for the proper arrangement and care of the collection when moved. Persons who have not been trained by previous study will be of very little use either in the removal of the collection, or for its rearrangement in a new locality, or for its proper care when so rearranged. I would, therefore, suggest that some additional junior assistants should be appointed, in order that they may be properly trained when the time for removal arrives. This is the more necessary, as all the senior assistants in the Zoological Department are, like myself, above sixty years of age; and some of them, including myself, will have exceeded the usual span of human life before a new building can be ready for the reception of the Collections, even were it to be put in hand immediately. In view of the contemplated removal, I cannot, therefore, but regard such an addition to our present staff as an essential preliminary.

*The Principal Librarian,*  
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