

The following papers were read, viz. :—

1. "The phenomena of Protective Mimicry, and its bearing on the theory of Natural Selection, as illustrated by the Lepidoptera of the British Islands," by Raphael Meldola, F.C.S. Communicated by A. G. Butler, Esq., F.L.S.

2. "An attempt towards a Systematic Classification of the family *Ascalaphidæ*," by Robert MacLachlan, Esq., F.L.S.

May 24th, 1871.

Anniversary Meeting.

George Bentham, Esq., President, in the Chair.

This day, the Anniversary of the Birth of Linnæus, and the day appointed by the Charter for the Election of Council and Officers, the President opened the business of the Meeting with the following Address :—

GENTLEMEN,—

HAVING now for the tenth time the honour of addressing you from this Chair on the occasion of your annual gathering, it has been my wish to lay before you a general sketch of the progress making in Systematic Biology, the foundation upon which must rest the theoretical and speculative as well as the practical branches of the science, to report upon the efforts made further to investigate, establish, and extend that foundation, and to convert the numerous quicksands with which it is beset into solid rock. This subject formed the chief portion of my Address of 1862, and again of those of 1866 and 1868; but on the present occasion I have had some difficulties to contend with. Mr. Dallas, to whose kindness I owed the zoological notes I required, has now duties which fully absorb his time; and I have been obliged to apply to foreign correspondents, as well as to my zoological friends at home, for the necessary information. They have one and all responded to my call with a readiness for which I cannot too heartily express my thanks*; and

* The gentlemen to whom I am more especially indebted for the useful memoranda they have transmitted to me are :—Dr. Lütken, through Dr. Lange of Copenhagen, for Denmark; Dr. Andersson and his zoological colleagues at Stockholm for the Scandinavian peninsula; M. Trautvetter, and through him

if there is some diversity in the extent and nature of the information I have received from different countries, which may prevent any very correct estimate of the comparative progress made in them, it is owing to the questions which I put having been stated too generally, and, though sent in the same words to my various correspondents, having been differently understood by them. In such a review, however, as I am able to prepare, I propose chiefly to consider the relative progress made by zoologists and botanists in the methods pursued and the results obtained,—in the first place as to general works common to all countries, and, secondly, as to those which are more particularly worked out in, or more specially relate to, each of the principal states or nations where biological science is pursued, prefacing this review by a few general remarks supplementary to those I laid before you in my first Address in 1862.

Since that time systematic biology has to a certain degree been cast into the background by the great impulse given to the more speculative branches of the science by the promulgation of the Darwinian theories. The great thunderbolt had, indeed, been launched, but had not yet produced its full effect. We systematists, bred up in the doctrine of the fixed immutability of species within positive limits, who had always thought it one great object to ascertain what those limits were and by what means species, in their never-ending variations and constant attempts to overstep those limits, were invariably checked and thrown back within their own domain, we might at first have felt disposed to resist the revolutionary tendency of the new doctrines; but we felt shaken and puzzled. The wide field opened for the exercise of speculative tendencies was soon overrun by numerous aspirants, a cry of contempt was raised against museum zoologists and herbarium botanists, and nothing was allowed to be scientific which was not theoretical or microscopical. But this has been carried, in some instances, too far. If facts without deductions are of little avail, assumptions without facts are worse than useless. Theorists in their disputes must bring forth the

M. von Schrenk of St. Petersburg, for Russia; Professor Troschel of Bonn for Central Europe; M. Aloïs Humbert, through M. de Candolle, for Switzerland; Sign. d'Achiardi on the part of Dr. Adolfo Savi, who was in attendance at his father's deathbed, for Italy; M. Decaisne and his zoological colleagues at the Jardin des Plantes (who, in the midst of their severe tribulations, kindly answered my queries during the short interval between the two sieges) for France; Professor Verrill, through Professor A. Gray, for the United States; and at home I have most cordially to thank Dr. Selater, Mr. Salvin, Mr. Gwyn Jeffreys, Mr. Stainton, Mr. M'Lachlan, and others of our Fellows, who have ever showed themselves most ready to reply to any questions I have put to them.

evidences they rely upon; and these evidences can only be derived from and tested by sound systematic Biology, which must resume, and is resuming, its proper position in the ranks of science, controlled and guided in its course by the results of those theories for which it has supplied the bases*. If the absolute immutability of races is no longer to be relied upon, the greater number of them (whether genera, species, or varieties) are at the present or any other geological period practically circumscribed within more or less definite limits. The ascertaining those limits in every detail of form, structure, habit, and constitution, and the judicious appreciation of the very complicated relations borne to each other by the different races so limited, are as necessary as the supplementing the scantiness of data from the depths of Teutonic consciousness or by the vivid flashes of Italian imagination, or as the magnifying minute and as yet undeveloped organisms with a precision beyond what is fully justified by our best instruments.

I am, however, far from denying, on the one hand, how much biological science has of late been raised, since it has been brought to bear, through well-developed theories and hypotheses, upon the history of our globe and of the races it has borne, and, on the other, how very much the systematic basis upon which it rests has been improved and consolidated by the assiduous use of the microscope and the dissecting-knife; but I would insist upon the necessity of equal ability being applied to the intermediate processes of method or nomenclature and classification, which form the connecting-link between the labours of the anatomist and the theorist, reducing the observations of the one to forms available for the arguments of the other. All three (the minute observer, the systematist, and the theorist), thus assisting each other, equally contribute to the general advancement of science; and for all practical application the systematist's share of duty is certainly the most important.

The quicksands to which I have alluded as besetting this the foundation of biological science may be classed as imperfect data and false data, imperfect method and false method. To show what progress is making in removing or consolidating them, it may be useful to consider what these data are, and what are our means of fixing them so as to be readily available for use.

It must, in the first place, be remembered that the races whose relations to each other we study can only be present to our minds in

* The great importance of morphology and classification, the elements of systematic biology, has been forcibly illustrated by Professor Flower in his last year's introductory lecture at the Royal College of Surgeons.

an abstract form. In treating of a genus, a species, or a variety, it is not enough to have one individual before our eyes; we must combine the properties belonging to the whole race we are considering, abstracted from those peculiar to subordinate races or individuals. We cannot form a correct idea of a species from a single individual, nor of a genus from a single one of its species. We can no more set up a typical species than a typical individual. If we had before us an exact individual representative of the common parent from which all the individuals of a species or all the species of a genus have descended—or, if you prefer it, an exact copy of the model or type after which the whole species or genus had been created—we should have no possible means of recognizing it. I once heard a lecture by a German philosophical naturalist of considerable reputation in his day, in which he thought he proved that the common Clover was the type of Papilionaceæ. His facts were correct enough, but his arguments might have been turned in favour of any other individual species that might have been selected. Suppose two individuals of a species, two species of a genus, two genera of a family, in one of which certain organs are more developed, more differentiated, or more consolidated than in the other; if we agree upon the question of which is the most perfect, a point upon which naturalists seldom do agree, how are we to determine which represents the common parent or model? whether the perfect one is an improvement upon or an improved copy, or the imperfect one a degeneracy from or a bad imitation of the other? No direct evidence goes beyond a very few generations; reasoning from analogy is impossible without direct evidence to start from; and the imaginary type without either is the business of the poet, not of the naturalist.

It follows that every such abstract idea of a race must be derived from the observation, by ourselves or by others, of as large a number of the constituent individuals as possible. However fixed a race may be, if fixed at all, in nature, that is not the case with our abstract idea of it: no species or genus we establish can be considered as absolute; it will ever have to be completed, corrected, or modified, as more and more individuals come to be correctly observed. Hence it is that a species described from a single specimen, and even a genus established on a single species, always excites more or less of suspicion, unless supported by strong reasoning from analogy or confirmed by repeated observation.

Our means of observing and methodizing biological facts, of establishing and classifying those abstract ideas we call varieties, species, genera, families, &c., consist in the study (1) of living

individual organisms, (2) of preserved specimens, (3) of pictorial delineations, and (4) of written descriptions. Each of these sources of information has its special advantages, but each is attended by some special deficiencies to be supplied by one or more of the others.

1. The study of living individuals in their natural state is without doubt the most satisfactory ; but very few such individuals can be simultaneously observed, for the purpose of comparison, and no one individual at any one moment can supply the whole of the data required, relating even to that individual. Some additional facilities in these respects are given by the maintenance of collections of living animals and plants, particularly useful in affording the means of continuous observation during the various phases of the life of one and the same individual, and sometimes through successive generations, or in facilitating the internal examination of organisms immediately after death, when the great physiological changes consequent upon death have only commenced. But there are drawbacks and difficulties to be overcome, as well as a few special sources of error to be guarded against ; and in this respect, as well as in the progress recently made in their application to science, there is a marked difference between zoological and botanical living collections, or so-called gardens.

The great drawback to living collections, especially zoological, is their necessary incompleteness. At the best it is individuals only, not species, and in a few cases genera, that are exposed to observation. Genera, indeed, can always be better represented than species, for a few species bear a much larger proportion to the total number contained in a genus than a few individuals to the total number which a species contains. Whole classes are entirely wanting in zoological gardens, which are usually limited to Vertebrata. Of late years means have been found to include a few aquatic animals of the lower orders ; but insects, for instance, those animals which exercise the greatest influence on the general economy of nature, the observation of whose life and transformations is every day acquiring greater importance, are wholly unrepresented in zoological gardens. The shortness of duration of their individual lives, their enormous powers of propagation, the different mediums in which they pass the different stages of their existence, will long be obstacles to the formation of living entomological collections on any thing like a satisfactory scale. The cost, also, of the formation and maintenance of living collections is very much greater in the case of animals than of plants ; but, on the other hand, zoologists have the advantage of the attractiveness of their menageries to the general unscientific

but paying public; and by judicious management some sacrifices to popular tastes are far outweighed by the additional funds obtained towards rendering their collections useful to science.

The false data or errors to be guarded against in the observation of living zoological collections are chiefly owing to the unnatural conditions in which the animals are placed. Ungenial climate, unaccustomed food, want of exercise, &c. act upon their temper, habits, and constitution; and confinement materially modifies circumstances connected with their propagation. Such errors or false data are no doubt as yet very few and unimportant compared with those which have arisen from the reliance on garden plants for botanical observations; but as zoological gardens multiply and extend, they will have to be more and more kept in view.

In my younger days there were already a number of small collections of living animals, but almost all either travelling or local menageries, exhibited for money by private individuals, or small collections, kept up as a matter of curiosity for the benefit of the public, such as those of the Pfauen Insel at Potsdam, the park at Portici, or our own Tower menagerie. At Paris alone, at the Jardin des Plantes, in the flourishing days of the Jussieus and Cuviers, was the living zoological collection rendered essentially subservient to the purposes of science. Since then, however, matters have much changed. The Jardin des Plantes, which so long reigned supreme, has, by remaining stationary, sunk into a second rank. She may, indeed, be as justly as ever proud of her Milne-Edwards, her Brongniart, her Decaisne, and many others; but, long out of favour with the government and the paying public, who transferred their patronage to the high-sounding Jardin d'Acclimatation, now no more, she has been almost abandoned to the resources of pure science, always of the most restricted in a pecuniary point of view. We, in the mean time, and, after our example, several Continental states or cities, have made great advances. The formation of our Zoological Society and Gardens opened a new era in the cultivation of the science. After various vicissitudes, the Society had the good fortune to secure the services of one who combined in the highest degree zoological eminence with administrative ability; and this, our great living zoological collection, is now raised to the proud relative position which the Jardin des Plantes once held, and which there seems every reason to hope it will long maintain. With an annual income of about £23,000, the Zoological Society is enabled to maintain a living collection of about a thousand species of Vertebrata; and although some portion of the surplus funds is neces-

sarily applied for the sole gratification of the paying public, yet a fair share is devoted to the real promotion of that science for which all the Fellows are supposed to subscribe—the accurate observation of the animals maintained, the dissection of those that die, and the publication of the results. Physiological experiments are either actually made in the garden or promoted and liberally assisted (such, for instance, as those on the transfusion of blood, the effects or non-effects of which were recently laid before the Royal Society by Mr. F. Galton); a very rich zoological library has been formed; and last year's accounts show a sum of about £1800 expended in the Society's scientific publications.

Zoological gardens after the example of the London one have been established, not only in several of our provincial towns, but in various Continental cities, amongst which the more important ones, as I am informed, are those of Amsterdam, Antwerp, Hamburg, Cologne, Frankfort, Berlin, Rotterdam, and Dresden, the receipts of the one at Hamburg, for instance, amounting annually, according to the published reports, to between £8000 and £9000. There are also so-called gardens of acclimatization; but these have not much of a scientific character; their professed object, indeed, is not so much the observation of the physiology and constitution of animals as their modification for practical purposes; and practically they are chiefly known as places of recreation, and are not always very successful. The great one in the Bois de Boulogne, now destroyed, out of an expenditure in 1868 of about £7200 showed a deficit of about £1600. A smaller one at the Hague is enabled to pay an annual dividend to its shareholders.

Living collections of plants have great advantages over those of animals; they can be so much more extensively maintained at a comparatively small cost. In several botanical gardens several thousand species have been readily cultivated at a comparatively small cost, and species can be represented by a considerable number of individuals—a great gain, especially where instruction is the immediate object; the lives of many can be watched through several successive generations, and great facilities are afforded for physiological experiments and microscopical observations on plants and their organs whilst still retaining more or less of life. On the other hand, the false data recorded from observations made in botanical gardens have been lamentably numerous and important. A plant in the course of its life so alters its outer aspect that each one cannot be individualized by the keeper of a large collection; and at one period, that of the seed in the ground, it is wholly withdrawn from

his observation : he is therefore obliged to trust to labels ; these are often mismatched by accident or by the carelessness of the workmen employed : or, again, one seed has been sown and another has come up in its place, or a perennial has perished and made room for a sucker or seedling from an adjoining species. The misnomers arising from these and other causes have become perpetuated and sanctioned by directors who, for want of adequate libraries or herbaria, or sometimes for want of experience or ability, have been unable to detect them. Plants have also been so disguised or essentially altered by cultivation, that it has become difficult to recognize their identity ; and new varieties or hybrids, which, if left to themselves, would have succumbed to some of the innumerable causes of destruction they are constantly exposed to in a wild state, have been preserved and propagated through the protective care of the cultivator, and pronounced at once to be new species. If, moreover, a misplaced label indicates that the seed has been received from a country where no plants of a similar type are known to grow, the director readily notes it as a new genus, and, proud of the discovery, gives it a name and appends a so-called diagnosis to his next seed-catalogue, adding one more to the numerous puzzles with which the science is encumbered. So far, indeed, had this nuisance been carried in several Continental gardens, in the earlier portion of the present century, that, excepting perhaps Fischer and Meyer's and a few other first-rate indexes, the great majority, perhaps nine-tenths, of the new species published in these catalogues have proved untenable ; and from my own experience I am now obliged *à priori* to set down as doubtful every species established on a garden-plant without confirmation from wild specimens. Fortunately, the custom is now abating, and directors of botanic gardens are beginning to perceive that they do not add to their reputation by having their names appended to those of bad species.

Living collections of plants, or botanical gardens, are of much older date than zoological ones, and since the sixteenth century have been attached to the principal universities which have medical schools, that of Padua dating from 1525, that of Pisa from 1544, and of Montpellier from 1597. The Jardin des Plantes of Paris, which in botany even more than in zoology so long reigned supreme, was established in 1610, our own first one, at Oxford, in 1632. These university gardens, having been generally more or less under the control of eminent resident botanists, have contributed very largely to the means of studying the structure and affinities of plants, especially in those Continental cities where a milder or more

steady climate has facilitated the maintenance of large collections in the open air or with little protection. Continental gardens have also been long and are still made largely available for the purpose of instruction as well as of scientific experiments, of which the recent labours of Naudin and Decaisne are an excellent illustration. For these scientific purposes the arrangement in large and small square compartments is peculiarly suitable; and I confess that I have frequently had greater pleasure in witnessing the facilities afforded to zealous students in following up, book in hand, the straight rows of scientifically arranged plants in these formal university gardens than in watching the gay crowds that flock to the more ornamentally laid out public botanic gardens.

I do not think that generally much advance has been made of late years in Continental botanical gardens. Those that I first visited in 1830 appeared to me to be but little improved when I again went over them in 1869. Some have acquired additional space, others have paid more attention to ornament; but most of them have remained nearly stationary, and a few have even fallen back. In our own country we have made great progress. Kew Gardens had, indeed, in former days rendered assistance to the investigations of Robert Brown and a few other favoured individuals; but they were the sovereign's private property, and were kept very close, with little encouragement to science at large. But thirty years' unceasing exertions on the part of its distinguished directors, the two Hookers, father and son, have raised them to a point of scientific usefulness far beyond any other establishment of the kind at home or abroad. Of the large sums annually voted for it by Parliament a portion has, indeed, to be applied to mere ornament and to the gratification of visitors; but yet, with all the drawbacks of our climate, and consequent expenditure in houses, a series of named species, representatives of all parts of the globe, far more numerous than had ever been collected in one spot, are there maintained, freely exhibited to the public, and submitted to the examination of scientific botanists.

2. Preserved specimens have the great advantage over living ones that they can be collected in infinitely greater numbers, maintained in juxtaposition, and compared, however distant the times and places at which they had been found; they are often the only materials from which we can obtain a knowledge of the races they represent; although still consisting of individuals only, they can by their numbers give better ideas of species and other abstract groups than the almost isolated living ones; and their careful preservation

supplies the means of verifying or correcting descriptions or delineations which have excited suspicion. Their great drawback is their incompleteness, the impossibility of deriving from them all the data required for the knowledge of a race or even of an individual. It is owing to the frequency with which characters supplied by preserved specimens, although of the most limited and unimportant nature, have been treated as sufficient to establish affinities and other general conclusions which have proved fallacious, that the outcry I have alluded to has been raised against museums and herbaria by those very theorists whose speculations would fall to the ground if all the data supplied by preserved specimens were removed from their foundations.

In respect of these deficiencies, as well as in the means of supplying them, there is a great difference between zoological and botanical museums. Generally speaking, zoological specimens show external forms only, botanical specimens give the means of ascertaining internal structure* ; and as a rule the characters most prominently or most frequently brought under the observer's notice acquire in his eyes an undue importance. Hence it is that external form was for so long almost exclusively relied upon for the classification of animals, whilst the minutæ of internal structure were at a comparatively early period taken account of by botanists ; and palæontologists are still led to give absolute weight to the most uncertain of all characters, outline and external markings of deciduous organs. External form, however, is really of far greater importance in animals than in plants ; the number, form, size, and proportions of limbs, the shape and colour of excrescences, horns, beaks, feathers, hairs, &c. in animals may be reckoned almost absolute in species when compared with the same characters in the roots, branches, and foliage and, to a certain extent, even in the flowers of plants. In plants, local circumstances, food, meteorological conditions, &c., act readily in modifying the individual and producing more or less permanent races of the lowest degree (varieties) ; whilst animals in these respects are comparatively little affected, except through those slow or occult processes by which the higher races, species or genera, in all organisms are altered in successive ages or geological periods. Even relative position of external parts, so constant in animals, is less so in plants. Animals being thus definite in outline, and a very

* By *internal structure* is here meant the morphology of internal organs or parts usually included in the comparative anatomy of animals, not the microscopical structure of tissues, which is more especially designated as vegetable anatomy.

large proportion of them manageable as to size, their preserved specimens, carcasses or skins, can be brought together under the observer's eye in considerable numbers, exhibiting at once characters sufficient for the fixation of species, whilst, with a few rare exceptions, a whole plant in its natural shape can never be preserved in a botanical museum. And although good botanical specimens have a general facies often sufficient to establish the species if the genus is known, yet the most experienced botanists have often erred in such determinations where they have been satisfied with external comparison without internal examination.

Identification of species, however, is but a small portion of the business of systematic biology; and for higher purposes, the classification of species, the study of their affinities, the preeminence of ordinary zoological over botanical specimens soon fails. Those characters distinguished by Prof. Flower as adaptive are proportionately more prominent, and the essential ones derived from internal structure are absent; and not only do the former thus acquire undue importance in the student's eyes, but arguments in support of a favourite theory have not unfrequently been founded on distortions really the result of bad preparation, although supposed to be established on the authority of actual specimens, and therefore very difficult to refute. Mounted skins of Vertebrata, showy insects in their perfect stage, shells of Malacozoa, corals, and sponges necessarily form the chief portion of a museum for public exhibition; but science and instruction require a great deal more: museum collections really useful to them should exhibit the animal, as far as possible, in all its parts and in all the phases of its life. This necessity has been felt in modern times, and resulted in the establishment of museums of comparative anatomy, amongst which that of our own College of Surgeons has certainly now taken the lead. But I have nowhere seen, except on a very small scale, the two museums satisfactorily combined: the idea, however, is not a new one; several zoologists have expressed their opinions on the desirableness of such an arrangement, which it is hoped will be duly considered in the formation of the new National Zoological Museums about to be erected at South Kensington for the double purposes of exhibition and science. The requirements of the gazing public are sure to be well provided for; and there is every reason to believe that the exertions of scientific zoologists will not have proved useless,—that we shall, in the portion devoted to science and instruction, see the skins of Vertebrata preserved without the artist's distortion, accompanied, as far as practicable, by corresponding

skeletons and anatomical preparations, as well as by the nests and eggs of the oviparous classes—insects with their eggs, larvæ, and pupæ, shells with the animals which produce them, &c.,—always with the addition, as far as possible, of the collectors' memoranda as to station, habit, &c., in the same manner as herbarium specimens are now frequently most usefully completed by detached fruits, seeds, young plants in germination, gums, and other products.

Here, however, will arise another source of false data, to be carefully guarded against—the mismatching of specimens, which in botany has probably produced more false genera and species than the misplacing of garden labels. The most careful collectors have in good faith transmitted flowers and fruits belonging to different plants as those of one species, the fruits perhaps picked up from under a tree from which they were believed to have fallen—or two trees in the same forest, with similar leaves, the one in flower, the other in fruit, supposed to be identical, but in fact not even congeners; and the mismatching at the various stages of drying, sorting, distributing, and finally laying in the specimens have been lamentably frequent. Collectors' memoranda, if not immediately attached to the specimens, or identified by attached numbers, have often led the naturalist astray; for collectors are but too apt, instead of noting down any particulars at the time of gathering, to trust to their memory when finally packing up their specimens. And so long as reasoning by analogy was never allowed to prevail over a hasty glance at a specimen and the memoranda attached to it, false genera and species arising from these errors were considered indisputable. *Magallana* of Cavanilles was till recently allowed materially to invalidate the character of *Tropæoleæ*, overlooking the strong internal evidence that it was founded upon the fruit of one natural order carelessly attached to a poor flowering specimen of another.

Zoological museums and botanical herbaria differ very widely in the resources at their disposal for formation, maintenance, and extension of their collections. Zoological museums are by far the most expensive, but, on the other hand, as exhibitions they can draw largely on the general public, whilst herbaria must rely mainly upon science alone, which is always poor; both, however, may claim national assistance on the plea of instruction as well as of pure science; and for practical or economic purposes the herbarium is even more necessary than the museum. The planning the new museums so as best to answer these several purposes for which they are required, has, I understand, engaged the attention of the Royal

Commission on scientific instruction and the advancement of science, and our most eminent zoologists have been consulted; any further observations on my part would therefore be superfluous. If our Government fail in their arrangements for the promotion of science, it will not be for want of having its requirements fully laid before them.

I am unable to say what progress has been made of late years in Zoological Museums; my notes on Continental ones were chiefly taken between the years 1830 and 1847, and would therefore be now out of date. It would, however, be most useful if some competent authority would undertake a tour of inspection of the more important ones, as in the great variety of their internal arrangements many a useful practical hint might be obtained; and we much want a general sketch of the principal Zoological and Botanical collections accessible to science, showing in what branch each one is specially rich, and where the more important typical series are now respectively deposited. In Herbaria a few changes have recently taken place, which it may be useful to record. Paris (I mean, of course, the brilliant Paris of a twelvemonth back) had lost considerably. Of the many important private herbaria I had been familiar with in earlier days, two only, those of Jussieu and of A. de St.-Hilaire, had been secured for the national collection; Webb's had gone to Florence; J. Gay's, which would have been of special value at the Jardin, was allowed to be purchased by Hooker, and presented by him to Kew. The celebrated herbarium of Delessert is removed to Geneva, whilst his botanical library, one of the richest in existence, is locked up within the walls of the Institut. These are but partially replaced by M. Cosson's herbarium, which has much increased of late years, and to which he added last spring the late Schultz Bipontinus's collections, rich in Compositæ. The national herbarium of the Jardin des Plantes is still one of the richest, but no longer *the* richest of all. The limited funds at the disposal of the Administration have allowed of their making but few acquisitions; their staff is so small and so limited in the hours of attendance that the increase of the last twenty years remains for the most part unarranged; and their library is most scanty. Science has been out of favour with their Governments of display. It would be out of place for me here to dwell upon the painful feelings excited in my mind by the dreadful ordeal through which a country I have been so intimately associated with for more than half a century is now passing, feelings rendered so acute by the remembrance of the uniform kindness I have received from private friends, as well as from

men of science, from Antoine Laurent de Jussieu and his colleagues to the eminent professors of the Jardin, who have now passed through the siege, that I may be allowed to express an anxious hope that when the crisis is passed, when the elasticity of French resources shall have restored the wonted prosperity, the new Government may at length perceive that, even politically speaking, the demands of science require as much attention as popular clamour.

The Delessertian herbarium has been well received at Geneva, where it has been adequately deposited in a building in the Botanical Garden, very near to the Natural-History Museum now erecting. At Paris it had been for some time comparatively useless, owing to the attempt to class it according to Sprengel's Linnæus; but now an active amateur committee, Messrs. Jean Mueller, Reuter, Rapin, and others, under the presidency of Dr. Fauconnet, have already made great progress in distributing the specimens under their natural Orders: and Geneva, already containing the important typical collection of De Candolle, as well as Boissier's stores rich especially in Mediterranean and Oriental plants, has become one of the great centres where real botanical work can be satisfactorily carried on; and as she has had the good sense to level her fortifications, she may accumulate national treasures with more confidence in the future. Munich had lost much of the prospects she had; the Bavarian Government failed to come to terms with the family of the late Von Martius; his botanical library has been dispersed, and his herbarium removed to Brussels, where it is to form the nucleus of a national Belgian collection. At Vienna the Imperial herbarium is now admirably housed in the Botanic Garden, and is in good order, with the great advantage of a rich botanical library in the same rooms. At Berlin, where the Royal herbarium, like the zoological museums, has always been kept in very excellent order, want of space is greatly complained of since it has been transferred to the buildings of the University. At Florence, as we learn from the '*Giornale Botanico Italiano*,' the difficulties with regard to the funds left by Mr. Webb for the maintenance of his herbarium have been overcome; and it is to be hoped that the liberal intentions of the testator, who made this splendid bequest for the benefit of science, will no longer remain so shamefully unfulfilled. To the above six may be added Leyden, Petersburg, Stockholm, Upsala, and Copenhagen as towns possessing national herbaria sufficiently important for the pursuit of systematic botany; but when I visited them, now many years since, they were all more or less in arrear in arrangement. I know not how far they may have since improved. In the United States of

America, the herbarium of Asa Gray, recently secured to the Harvard University, now occupies a first rank. That of Melbourne in Australia, founded by Ferdinand Mueller, has, through his indefatigable exertions, attained very large proportions; and that of the Botanical Garden of Calcutta, under the successive administrations of Dr. Thomson and the late Dr. T. Anderson, had recovered in a great measure its proper position, which I trust it will henceforth maintain. Our own great national herbarium and library at Kew is now far ahead of all others in extent, value, and practical utility; originally created, maintained, and extended by the two Hookers, father and son, their unremitting and disinterested exertions have succeeded in obtaining for it that Government support without which no such establishment can be rendered really efficient, whilst their liberal and judicious management has secured for it the countenance and approbation of the numerous scientific foreigners who have visited or corresponded with it. Of the valuable botanical materials accumulated in the British Museum during the last century, I say nothing now; for the natural-history portion of that establishment is in a state of transition, and my own views as regards botany have been elsewhere expressed. I have only to add that we have also herbaria of considerable extent at the Universities of Oxford, Cambridge, and at Edinburgh, and at Trinity College, Dublin, and to express a hope that the necessity of maintaining and extending them will be duly felt by those great educational bodies, if they desire to secure for their Professorial chairs botanists of eminence.

3. Pictorial representations or drawings have the advantage over Museum specimens that they can be, in many respects, more complete; they can represent objects and portions of objects which it has been impossible to preserve; they can give colour and other characters-lost in the course of desiccation; they preserve anatomical and microscopical details in a form in which the observer can have recourse to them again and again without repeating his dissections; and although, like a Museum specimen, each drawing represents usually an individual, not a species, yet that individual can by exact copies be multiplied to any extent for the simultaneous use of any number of naturalists; whilst specimens of the same species in different museums are corresponding only, not identical, and imperfect comparison and determination of specimens supposed to be authentic (*i. e.* exactly corresponding to the one originally described) have led into numerous errors. Drawings, moreover, by diagrams and other devices, can represent more or less perfectly the abstract

ideas of genera and species; they can exhibit the generic or specific characters more or less divested of specific or individual peculiarities.

Drawings, on the other hand, are, much more than specimens, liable to imperfections and falsifications, arising from defective observation of the model and want of skill in the artist; and errors thus once established are much more difficult of correction than even those conveyed by writing. A pictorial representation conveys an idea much more rapidly and impresses it much more strongly on the mind than any detailed accompanying description by which it may be modified or corrected, and is but too frequently the only evidence looked into by the more theoretical naturalist. This is especially the case with microscopical and anatomical details of the smaller animals and plants, the representations of which, if very elaborate and difficult to verify, usually inspire absolute confidence. Drawings are also costly, often beyond the means of unaided science, who here, again, as in the case of gardens and museums, is obliged to have recourse to the paying public: the public in return require to have their tastes gratified; artistic effect is necessarily considered, thus increasing the cost, and removing the pictures still further from the reach of the working biologist. It appears to me that collections of drawings systematically arranged have not generally met with that attention which they require from Directors of Museums, and that their multiplication in an effective and cheap form ought to be a great object on the part of governments, scientific associations, and others who contribute pecuniarily to the advancement of science.

To be effective, the first requisites in a zoological or botanical drawing are accuracy and completeness; it is a faithful representation, not a picture, that is wanted. Many a splendid portrait of an animal or plant, especially if grouped with others in one picture, has been rendered almost useless to science by a graceful attitude or an elegant curve which the artist has sought to give to a limb or to a branch; and those analytical details which are of paramount importance to the biologist are neglected because they spoil the general effect. We next require from an illustration as from a description that it should be representative or to a certain degree abstract; and this requires that the artist, if not himself the naturalist, should work under the naturalist's eye, so as to understand what he delineates. Great care should be taken to select for the model an individual in a normal state as to health, size, &c., and in the selection and arrangement of the anatomical details, so as to represent the race rather than the individual—all of which requires a thorough acquaintance with the questions to be attended to. It

is true that the artist, working independently and copying mechanically, may serve as a check on the naturalist, who in minute microscopic examinations may be apt to see too much in conformity to preconceived theories; but that is not often the case: the most satisfactory analytical drawings I have always found to be those made by the naturalist's own hand, and I have long felt how much my own inability to draw has detracted from the value of the botanical papers I have published. And, thirdly, when we consider that the great advantage of an illustration over a description is that the one gives us at a glance the information which we can only obtain from the other by study, we require that each drawing or plate should be as comprehensive as is consistent with clearness and precision. Outline drawings, or portraits without structural details, often omit the essential characters we are in search of; where details are unaccompanied by a general outline, we miss a great means of fixing their bearing on our own minds. Structural details may also equally err in being too numerous or too few, on too large or on too small a scale. If the plate is crowded with details of little importance, or which may be readily taken from the general outline, they draw off the attention from those which it is essential should be at once fixed on the mind; and if enlarged beyond what is necessary for clearness, they require so much the more effort to comprehend them, unless, indeed, they are destined to be hung up on the walls of the lecture room. I believe it to be the case with some drawings of the muscles of vertebrata, or of the internal structure of insects, as I know it to be with those of ovules and other minute parts of flowers of the late Dr. Griffith and others, that, with their very high scientific value, their practical utility is much interfered with by the large scale on which they are drawn. A great deal depends also on the arrangement in the plate, always keeping in mind that the object is not to please the eye, but to convey at one view as much as possible of comparative information without producing confusion.

Biological illustrations in general have much improved in our time. It is true that some of the representations of animals and plants dating from the middle of last century will enter into competition with any modern ones as to general outline and facies; but analytical details were almost universally neglected, and colouring, when attempted, was gaudy and unfaithful. At present, I believe, we excel in this country in the general artistic effect, as, unfortunately also for the naturalist, in the costliness of our best zoological and botanical plates; the French are remarkable for the selection,

arrangement, and execution of the scientific details (and as a model I may refer to some of the publications of the Paris Museum, such as the 'Malpighiaceæ' of Adrien de Jussieu), and also for the excellent woodcuts illustrating their general and popular works; the Germans and some Northern States for the admirable neatness of microscopic and other minutiae executed at a comparatively small cost, owing partially, at least, to the use of engraving on lithographic stone.

4. Written descriptions are what we most chiefly rely upon to convey to the general or to the practical naturalist the results of our studies of animals and plants; but descriptions are of two kinds, individual descriptions and descriptions of species, genera, or other races. The former are, like preserved specimens or delineations, materials for study; like them they require in their preparation little more than artistical skill, guided by a general knowledge of the subject: but abstract descriptions, whether specific or relating to races of a higher degree, require study of the mutual relations of individuals and races and their consequent classification which constitute the science of systematic biology; and this distinction should be constantly kept in view for the just appreciation of all descriptive works. Any tyro can with care write a long description of a specimen unimpeachable as to accuracy; but it requires a thorough knowledge of the subject, and a keen appreciation of the bearing of the points noticed, to prepare a good description of a species. For the latter to be serviceable it must be accurate; it must be full without redundancy; it must be concise without sacrificing clearness; it must be abstractive, not individual; and lastly, the most difficult qualification of all, and that which constitutes the main point of the science, the abstraction must be judicious and true to Nature.

The paramount importance of accuracy is too evident to need dwelling upon. We are all liable to errors of observation. Imperfect vision or instruments, optical deceptions, accidentally abnormal conditions of the specimen examined, hasty appreciation of what we see from preconceived theories are so many of the causes which have occasionally led into error the most eminent of naturalists, and require to be specially guarded against by repeated observation of different specimens, and constant testing at every step by reasonings from analogy. Errors once established on apparently good authority are exceedingly difficult to correct, and have been the source of many a false theory. Where loose examination and hasty conclusions have been frequently detected, we can at once renounce all confidence in an author's descriptions, in his genera and species, un-

less confirmed from other sources; but an accidental oversight on the part of a naturalist of established reputation is the most difficult to remedy, notwithstanding the eagerness with which some beginners devote themselves to hunting them out. No botanist was, I believe, ever more careful in verifying his observations over and over again, and in submitting them to the tests supplied by the extraordinary methodizing powers of his mind, than Robert Brown; no one has ever committed fewer of what we call blunders, or established his systematic theories on safer ground; yet even he has been detected in a few minor oversights, eagerly seized upon by a set of modern speculative botanists, lovers of paradoxes, as justifying them in devoting their time and energies to the disputal of several of his more important discoveries and conclusions.

The value of a description as to fulness and conciseness is practical only, but in that point of view important. A description, however accurate, is absolutely useless if the essential points are omitted, and very nearly so if those essential points are drowned in a sea of useless details. The difficulty is to ascertain what are the essential points,—and hence one of the causes of the superiority of Monographs and Floras over isolated descriptions, such as those of Zoologies and Botanies of Exploring Expeditions, which I insisted on in my Address in 1862: in the former the author must equally examine and classify all the allied races, and thus ascertain the essential points; in the latter case he is too easily led to trust to what he believes to be essential. My own long experience in the using as well as in the making of botanical descriptions has proved to me how difficult it is to prepare a really good one, how impossible to do it satisfactorily from a first observation of a single specimen. However carefully you may have noted every point that occurs to you, you will find that after having comparatively examined other specimens and allied forms you will have many an error to correct, many a blank to fill up, and much to eliminate. I have had more than once to verify the same species in two authors, the one giving you a character of a few lines which satisfies you at once, the other obliging you to labour through two or three quarto pages of minute details from which, after all, some of the essential points are omitted.

But the great problem to be solved at every stage in systematic or descriptive biology, and that which gives it so high a scientific importance, is the due detection and appreciation of affinities and mutual relations; and in this respect the science has made immense progress within my own recollection, and especially during the last few years. The gradual supplanting of artificial by natural classi-

fications has been too often commented upon to need repetition. It is now, I believe, universally admitted that a species is the totality of the individuals connected together by certain resemblances or affinities the result of a common descent. It is also acknowledged that for scientific purposes these species should be arranged in groups according to resemblances or affinities more remote than in the case of species, although here commences the great difference of opinion as to the meaning of these remoter affinities, whether they also are the result of a common descent, or of that supposed imitation of a type which I have above alluded to. For those, however, who have once connected affinity with consanguinity, it is difficult to recede from so ready an explanation of those mysterious resemblances and differences the study of which must be the ruling principle to guide us in our classifications. All this has now been fully explained by more able pens than mine; my only object in repeating it is to point out clearly the need of treating all systematic groups, from the order down to the genus, species, or variety, as races of a similar nature, collections of individuals more nearly related to each other than to the individuals composing any other race of the same grade, and of abolishing the use of the expression type of a genus or other group in any other than a purely historical sense as a question of nomenclature*. If a genus has to be divided, our laws of nomenclature require the original name to be retained for that section which includes the species which the founder of the genus had more specially observed in framing his character; and therefore, and for that reason only, it becomes necessary to inquire which was or which were the so-called typical species—the biologist's (or, as it were, the artist's), not Nature's type.

Without repeating what I have often said of the comparative value of Monographs and Faunas or Floras over miscellaneous descriptions, I may observe that the immense progress made in the accumulation of known species henceforth diminishes still more the relative importance to science of the addition of new forms when compared with the due collocation and correct appreciation of those already known. Much has been done of late years in the latter respect; but yet some branches of biology, and perhaps entomology more than any other, are very much in arrear as to supplying us with

* For the purposes of instruction some one species is often named as a type of a genus—that is to say, as fairly representing the most prevalent characters; but to prevent any confusion with *the* imaginary type, it would surely be better to call it an *example*, as, indeed, is often done. In geographical biology the word type is used again in another sense, which, however, does not lead to any misunderstanding.

available data for investigating the history of species and their genealogy, their origin, progress, migrations, mutual relations, their struggles, decay, and final extinction. It is to be feared that in insects, as in plants, but too large a proportion of the innumerable genera and subgenera have been founded rather on the sortings of a collector than on the investigation of affinities; and, indeed, that must in a great measure be the case so long as a large number are only known from their outward form at one period only of their varied phases of existence.

The days of a 'Systema Naturæ' or single work containing a synopsis of the genera and species of organized beings are long since passed away. Even a 'Species Plantarum,' now that their number at the lowest estimate exceeds 100,000, has become almost hopeless. The last attempt, De Candolle's 'Prodromus,' has been nearly forty years in progress; the first portion has become quite out of date; and all we can hope for is that it may be shortly completed for one of the three great classes. Animals might have been more manageable, were it not for the insects. Mammalia estimated at between 2000 and 3000 living species, Birds at about 10,000, Reptiles and Amphibia under 2000, Fishes at about 10,000, Crustacea and Arachnida rather above 10,000, Malacozoa about 20,000, Vermes, Actinozoa, and Amorphozoa under 6000, would each by themselves not impose too heavy a tax on the naturalist experienced in that special branch who should undertake a scientific classification and diagnoses of all known species; and in one important branch, the Fishes, this work has been most satisfactorily carried out in Dr. Günther's admirable genera and species of all known Fishes, published under the misleading title of 'Catalogue of the Fishes in the British Museum,' and recently completed by the issue of the eighth volume. The sound philosophical views expressed in his preface to that volume (which, by some strange inversion, bears a signature not his own) can be appreciated by us all; and zoologists are all agreed as to the care with which they have been worked out in the details. Insects are, however, the great stumbling-block of zoologists; the number of described species is estimated by Gerstäcker at about 160,000, viz. Coleoptera 90,000, Hymenoptera 25,000, Diptera 24,000, Lepidoptera 22,000-24,000. Mr. Bates thinks that, for the Coleoptera at least, this estimate is too high by one-third; but even with that deduction the number would exceed that of plants, and it is probable that the number of as yet undiscovered species in proportion to that of the described ones is far greater in the case of insects than in plants. We can therefore no longer hope for a 'Genera and Species'

of insects, the work of a single hand or, indeed, guided by a single mind. The great division of labour, however, now prevalent among entomologists may procure it for us in detail, with one drawback only, that the smaller the portion of the great natural class of Arthropoda to which the entomologist confines his attention, the less he will be able to appreciate the significance of distinctive characters, and the more prone he will be to multiply small genera (that is, to enhance beyond their due the races of the lowest grade), to the great inconvenience of the general naturalist who has to make use of the results of his labours.

A 'Genera Plantarum' is still within the capabilities of a single botanist, although he must of course trust much to the observations of others, and therefore not so satisfactory as if he had examined every species himself. The last complete one was Endlicher's, the result of several years' assiduous labour, but now thirty years old. Dr. Hooker and myself commenced a new one, of which the first part was published in 1862, and which might have been brought nearly to a close by this time had we not both of us had so many other works on hand to deter us, although the researches necessary for these other works have proved of great assistance in the 'Genera.' As it is, the part now nearly ready for press carries the work down to the end of Compositæ, or about half through the Phænogamous Plants. In regard to works of a still more general description, or exposition of the families or orders of plants, we have nothing of importance since Lindley's 'Vegetable Kingdom,' dated 1845, but republished, with some additions and corrections, in 1853; and Le Maout and Decaisne's 'Traité Générale,' mentioned in my Address of 1868, and of which Mrs. Hooker is now preparing an English translation under the supervision of Dr. Hooker. Dr. Baillon has also commenced an 'Histoire des Plantes,' containing a considerable number of useful original observations and illustrated by excellent woodcuts; but, as a general work, one portion is of too popular a character, and in some cases too diffuse, to be of much use to science, and, on the other hand, the generic characters are too technical for a popular work without any contrasted synopsis; and its great bulk in proportion to the information conveyed will always be a drawback. I cannot believe that the author can have been a party to the unblushing announcement of the French publisher that it is to be completed in about eight volumes. If carried out on the plan of the first one, it must extend to four or five times that number. In Zoology Bronn's most valuable 'Klassen und Ordnungen des Thierreichs,' continued after his

death by Keferstein and others, which I mentioned in my Address of 1866, has advanced but slowly. The Amorphozoa, Actinozoa, and Malacozoa, forming the first two volumes, were then completed; and Gerstäcker has since been proceeding with the Arthropoda, commencing with the Crustacea, for the third volume, of which only the general matter and the Cirripedia and Copepoda are as yet published; and three or four parts of a sixth volume for Birds have been issued by Selenka, treating the anatomical and other general matter in great detail. Another general work of merit, although on a smaller scale, has been proceeding as slowly. Of Carus and Gerstäcker's 'Handbuch der Zoologie,' the second volume, containing the Arthropoda, Malacozoa, and lower animals, had been already published in 1861; and to this was added, in 1868, the first half of the Vertebrata for the first volume, with a promise that the remainder should appear in the autumn, but which has not yet been fulfilled. Among the other recently published systematic zoological handbooks of which I have had memoranda as published in various Continental states, the most important are said to be:—Harting's, published at Tiel in the Netherlands, of which, up to 1870, only three volumes had appeared, containing the Crustacea, Vermes, Malacozoa, and lower animals; A. E. Holmgren's Swedish 'Handbok i Zoologi,' of which Mammalia were published in 1865 and Birds in 1868-71; and Claus's 'Grundzüge' and Troschel's 'Handbuch' (7th edition) for University teaching in Germany.

In a comparative sketch of the more partial Monographs, Faunas, and Floras, I had wished to direct my attention more especially to the means afforded us of comparing the plants and animals of different countries; and with this view one of the questions I addressed to foreign zoologists was, "What works or papers are there in which the animals (of any of the principal classes) of your country are compared with those of other countries?" The answers to this query have not been generally satisfactory. Where the zoology has been well investigated, we have popular handbooks, elaborate memoirs, and works of high scientific value or splendidly illustrated. But short synoptical faunas, so useful to the general naturalist, and corresponding to the Floras we now possess of so many different countries, are very few; the statement of the general geographical range of each species, so prominent a feature in many modern Floras, is still less thought of; and indications of allied or representative races in distant countries are equally rare. We have, indeed, several excellent essays on the geographical distribution of animals (I had occasion to allude to several of them in my Address of 1869); but

they are in general chiefly devoted to discussions, with statements of such facts only as bear upon the author's conclusions, not records of all facts which may be useful to the geographical or general biologist. These must be collected from a great variety of separate works and papers, of which I have received long lists from Denmark, Sweden, Germany, Switzerland, Italy, France, and the United States. As yet I have only had time to refer to a few which appeared to bear more immediately on the objects I had in view; but I hope on some future occasion to return to the subject. In the mean time I must content myself with glancing rapidly over the different countries, taking them in the order adopted in my former Addresses, and endeavouring to show the progress making in supplying our deficiencies. Towards these deficiencies I would particularly call the attention of entomologists and terrestrial malacologists; for insects and land-shells are of all others the animals whose life and local stations are the most closely dependent on vegetation. In the following notes I refrain from entering into any details as to the zoological works or memoirs mentioned, as they are entirely superseded by the analysis given in the annual review inserted in Wiegmann's 'Archiv,' and more especially in our own admirably conducted 'Zoological Record,' which so strongly claims the support of every one interested in the promotion of Zoological Science.

I. DENMARK.

In geographical biology Denmark proper is of no great importance except as a connecting-link, on the one hand, between the Scandinavian peninsula and Central Europe, and, on the other, as the separating barrier between the Baltic and the North seas. Low and flat, without any great variety in its physical features, it is unfavourable for the production or maintenance of endemic organisms, and forms an inseparable portion of the region of Central Europe. But the Arctic possessions included in the kingdom, Greenland, Iceland, and the Faroe Islands, are of great interest; and Denmark itself is remarkable for the number of eminent naturalists, zoologists as well as botanists, produced by so small a state. Its reputation in this respect, established by the great names mentioned in my review of Transactions in my Address of 1865, is being well kept up by Bergh, Krabbe, Lütken, Mörch, Reinhardt, Schiötte, Steenstrup, and others in zoology; whilst Lange, Örsted, and Warming are among the few who now devote themselves more or less to systematic botany. Their general zoological collection, when I last visited it, many years since, was not extensive, although rich in northern

animals and very well arranged under the direction of Steenstrup, and the insects in the Storm-Gade Museum were very numerous; whilst at the University was deposited the typical collection of Fabricius. The Herbarium at the Botanic Garden, valuable for the types of Vahl and other early botanists, has been in modern times enriched by the extensive Mexican collections of Liebmann, the Brazilian ones of Lund and others; whilst Ærsted's Central-American and Warming's Brazilian plants are also at Copenhagen, but whether public or private property I know not. The botanical and zoological gardens are of no great importance; but the biological publications are kept up with some spirit, especially the Transactions of the Royal Society of Science, Schiödte's continuation of Krøyer's 'Tidsskrift,' and the 'Videnskabelige Meddelelser' of the Natural-History Society; and some of the authors have adopted a practice strongly recommended to those who write in languages not understood by the great mass of modern naturalists, that of giving short *résumés* of their papers in French. On the most important contributions to systematic zoology since those mentioned in my Address of 1868, I have received the following memoranda:—Prof. Reinhardt, in publishing in the Transactions of the Royal Danish Academy (1869) nine posthumous plates, executed under the direction of the late Prof. Eschricht, illustrating the structure of various Cetacea, has accompanied them with short explanations. Prof. Reinhardt has further published, in the 'Videnskabelige Meddelelser' for 1870, a list of the Birds inhabiting the Campos districts of Central Brazil; "notes on the distribution, habits, and synonymy are copiously added; and the introductory remarks on the geographical distribution &c. are very suggestive, and ought to be translated for the benefit of the friends of ornithology in England and elsewhere." The same 'Videnskabelige Meddelelser' contains an essay by Dr. Lütken on the limits and classification of Ganoid Fishes, chiefly from a palæontological point of view, accompanied by a synopsis of the present condition, in systematical and geological respects, of that important branch of Palæichthyology. In Mollusca, Dr. Bergh has published, in Krøyer's 'Tidsskrift' for 1869, one of his elaborate anatomical and systematic monographs of the tribe Phylidæ, with many plates, of which a detailed notice is given in the 'Zoological Record,' vol. vi. p. 559. In Insects, Prof. Schiödte, in the same journal for 1869, has given an elaborate essay containing new facts and views on the morphology and system of the Rhynchota, analyzed in the 'Zoological Record,' vol. vi. p. 475. "To Dr. Krabbe we owe the description of 123 species of tapeworms found in Birds,

an elaborate monograph accompanied by ten plates, and printed in the Transactions of the Royal Danish Society for 1869, with a French *résumé*” (noticed in ‘Zoological Record,’ vol. vi. p. 633). In Echinoderms, Dr. Lütken’s valuable essays on various genera and species of Ophiuridæ, recent and fossil, with a Latin synopsis of Ophiuridæ and Euryalidæ, and a general French *résumé*, forming the third part of his “Additamenta ad Historiam Ophiuridarum,” in the Transactions of the Royal Danish Society for 1869, have been analyzed in the ‘Zoological Record,’ vol. vi. pp. 639, 642, &c. No contribution to systematic botany, of much importance, has appeared in Denmark since those mentioned in my Address of 1868.

There exists no general Danish Fauna; but I have a rather long list of detached works and essays from which the different classes of animals inhabiting Denmark may be collected. Of these the most recent are Collin’s Batrachia, in Krøyer’s ‘Tidsskrift’ for 1870, and Mörch’s marine Mollusca, publishing in the ‘Videnskabelige Meddelelser’ for the present year.

With regard to Iceland, the only works mentioned are Steenstrup’s terrestrial Mammals, or rather Mammal, of Iceland, in the ‘Videnskabelige Meddelelser’ for 1867; Mörch’s Mollusca in the same journal for 1868. C. Müller’s account of the Birds of Iceland and the Faroe islands dates from 1862, and Lütken’s of the Echinoderms from 1857; and I find no mention, of any special account, of the insects of the island; whilst in Botany C. C. Babington has given us, in the 11th volume of our Linnean Journal, an excellent revision of its flora, the phænogamic portion of which may now be considered as having been very fairly investigated; and E. Rostrup, in the 4th volume of the Tidsskrift of the Botanical Society of Copenhagen, has enumerated the plants of the Faroe islands.

II. SWEDEN AND NORWAY.

The Scandinavian peninsula is, on several accounts, of great interest to the biologist. It includes a lofty and extensive mountain-tract, with a climate less severe than that of most parts of the northern belt at similar latitudes; and the uniformity of the geological formation is broken by the limestone districts of Scania. It thus forms a great centre of preservation for organic races between the wide-spread tracts of desolation to the east and the ocean on the west, and has therefore been treated as a centre of creation, whence a Scandinavian flora and fauna has spread in various directions. As the home of Linnæus it may also be considered classical ground for systematic biology, the pursuit of which is now being carried on

with spirit, as evidenced by such names as Holmgren, Kinberg, Liljeborg, Malm, Malmgren, G. O. Sars, Stål, Thorell, and others in Zoology, and Agardh, Andersson, Areschoug, Fries, Hartmann, and others in Botany. Two of the Academies to whose publications Linnæus contributed, those of Upsala and Stockholm, continue to issue their Transactions and Proceedings; and to these are now added the memoirs published by the University of Lund. They lost Linnæus's own collections; and the Zoological Museum at Upsala, when I saw it many years since, was poor; that of Stockholm better, and in excellent order. In the Herbaria, Thunberg's and Afzelius's collections are deposited at Upsala, and Swartz's at Stockholm, where the Herbarium of the Academy of Sciences has been of late years considerably increased under the care of Dr. Andersson.

The Scandinavian Fauna and Flora have been generally well investigated. The numerous Floras published of late years show considerable attention on the part of the general public. I observe that Hartmann's Handbook is at its tenth edition; Andersson has published 500 woodcut figures of the commoner plants, taken chiefly from Fitch's illustrations of my British Handbook; and my lists contain many papers on Swedish Cryptogams. The relation of the Scandinavian vegetation to that of other countries has also been specially treated of by Zetterstedt, who compared it with that of the Pyrenees—and by Areschoug, Andersson, Ch. Martins, and others, as alluded to in more detail in my Address of 1869. Many works have succeeded each other on the Vertebrate Fauna since the days of Linnæus; amongst which those of Liljeborg as to Vertebrata in general and of Sundevall as to Birds are still in progress. The Crustacea, Mollusca, and lower animals have been the subjects of numerous papers, the marine and freshwater faunas having been more especially investigated by the late M. Sars and by G. O. Sars; and Th. Thorell, in the Upsala Transactions, has given an elaborate review of the European genera of Spiders, evidently a work of great care, preceded by apposite remarks on their generic classification, and a general comparison of the Arachnoid faunæ of Scandinavia and Britain, all in the English language although published in Sweden. This work, however, does not extend to species, beyond naming a type (by which I trust is meant an example, not the type) of each genus; nor is the geographical range of the several genera given. There appears to be no general work on Scandinavian Insects.

The Fauna and Flora of Spitzbergen have specially occupied Swedish naturalists. To the accounts of the Vertebrata by Malmgren, and of the Lichens by T. M. Fries, have now been added, in

recent parts of the Transactions or Proceedings of the Royal Swedish Academy, the Insects by Holmgren, the Mollusca by Mörch, the Phænogamic Flora by T. M. Fries, and the Algæ by Agardh.

An excellent and elaborate monograph of a small but widely spread genus of Plants, entitled 'Prodrômus Monographiæ Georum,' by N. J. Schantz, has appeared in the last part of the Transactions of the Academy of Upsala. Several interesting features in the geographical distribution of some of the species are pointed out, amongst which one of the most curious is the almost perfect identity of the *G. coccineum* from the Levant and the *G. chilense* from South Chile, the differences being such only as would scarcely have been set down as more than varieties had both come from the same country. The whole memoir is in the Latin language; the specific diagnoses are rather long; but the observations under each section and species point out the connexion with and chief differences from the nearest allies.

The whole of the botanical literature published in or relating to Sweden has been regularly recorded in annual catalogues, inserted by T. O. B. N. Krok in the 'Botaniske Notiser' of Stockholm.

III. RUSSIA.

The chief interest in the biology of Russia consists in its comparative uniformity over an enormous expanse of territory. Extending over more than 130 degrees from east to west, and above 20 degrees from south to north, without the interposition of any great geological break in mountain* or ocean, all changes in flora and fauna in the length and breadth of this vast area are gradual; whilst the mountains which bound it to the south and to the east, and the glacial characters of the northern shores, offer to the Russian naturalist several more or less distinct biological types, such as the Caucasian, the Central Asiatic, the Mantchurian, and the Arctic, all blending into the great Europeo-Asiatic type, and the three first-named, at least apparently, constituting great centres of preservation. By the careful discrimination of the various races which give to each of these types its distinctive character, the study of their mutual relations, of the areas which each one occupies without modification, of the complicated manner in which these several areas are interwoven, of the gradual changes which distance may

* The celebrated chain of the Oural, which separates Asia from Europe, is, in the greater part of its length, too low and the ascent too gradual to have much influence on the vegetation: the so-called ridge between Perm and Ekaterinburg is, according to Ermann, not 1600 feet above the level of the sea, and rises from land which, for a breadth of above 120 miles, is only 700 feet lower.

produce, of the cessation of one race and the substitution of another without apparent physical cause, the Russian, even without travelling out of his own country, can contribute, more than any other observer, valuable materials for the general history of races. In Botany I have on former occasions referred to Ledebour's 'Flora Rossica' as the most extensive complete Flora of a country which we possess, and to the numerous papers by which it has been supplemented. Several of these are still in progress, chiefly in the Bulletin of the Society of Naturalists of Moscow; and I have notes of local Floras, and lists from various minor publications. The last received volume of the Memoirs of the Academy of St. Petersburg includes the botanical portion of Schmidt's travels in the Amur-land and Sachalin, in which the geographical relations of the flora are very fully treated of—and the first part of a very elaborate 'Flora Caucasi' by the late F. J. Ruprecht, which may be more properly designated Commentaries on the Caucasian Plants than a Flora in the ordinary sense of the word. It is an enumeration of species, with frequent observations on affinities, and a very detailed exposition of stations in the Caucasus, but without any reference to the distribution beyond that region; above 300 large 4to pages only include the Polypetalæ preceding Leguminosæ; and the lamented death of the author will probably prevent the completion of the work. N. Kaufmann, Professor of Botany at the University of Moscow, an active botanist of great promise, whose death last winter is much deplored by his colleagues, had published a Flora of Moscow in the Russian language, which had met with much success. In the zoology of Russia the most important recent work is Middendorff's 'Thierwelt Sibiriens,' analyzed in the 'Zoological Record,' vi. p. 1, which, with the previously published descriptive portion and the botany of the journey by Trautvetter, Ruprecht, and others, forms a valuable exposition of the biology of N.E. Siberia, a cold and inhospitable tract of country, where organisms, animal as well as vegetable, are perhaps poorer in species and poorer in individuals than in any other region of equal extent not covered with eternal snows. Middendorff's observations on this poverty of the fauna of Siberia, its uniformity and conformity to the European fauna, on the meaning to be given to the species, on their variability and on the multiplicity of false ones published, on the complexity of their respective geographical areas, on their extinction and replacement by others, &c. are deserving of the careful study of all naturalists. L. v. Schrenck's Mollusca of the Amur-land or Mantchuria (reviewed in the 'Zoological Record,' iv. p. 504) is equally to be recommended for the manner in which the

specific relations, the variability, affinities, and geographical distribution of Mantchurian Mollusca are treated. The publications of the first meeting of the Association of Russian Naturalists include a review of the Crustacea of the Black Sea by V. Czerniavski, an account of the Annulata Chætopoda of the Bay of Sebastopol by N. Bobretzki, and a paper on the zoology of the Lake of Onega and its neighbourhood by K. Kessler, including a review of the Fishes, Crustacea, and Annulata of the Lake of Onega, and of the Mollusca collected in and about the Lakes Onega and Ladoga, and a list of the Butterflies of the Government of Olonetz. The historical and scientific memoirs published by the University of Kazan, of which several volumes have recently reached us, include a systematic enumeration and description of the birds of Orenburg (329 species), with detailed notes of their habits &c., by the late Prof. E. A. Eversmann, edited after his death by M. N. Bogdanoff, forming an 8vo volume of 600 pages in the Russian language.

There is not in Russia at the present moment sufficient encouragement on the part of the public to induce the publication of independent biological works beyond a few popular handbooks; but the Imperial Academy of Petersburg has, on the other hand, been exceedingly liberal in the assistance it affords, and active in its issue of Transactions with excellent illustrations, as well as of its Bulletin or Proceedings. The volumes recently received include J. F. Brandt's 'Symbolæ Sirenologicæ' and Researches on the genus *Hyrax* (reviewed in 'Zoological Record,' v. p. 3, and vi. p. 5), A. Strauch's Synopsis of Viperidæ, with full details of their geographical distribution, E. Metschnikoff's Studies on the development of Echinoderms and Nemertines, and N. Miklucho-Maclay's Memoir on Sponges of the N. Pacific and Arctic Oceans, with remarks on their extreme variability inducing the multiplication of false species. In Botany, Bunge's Monograph of the Old-World species of *Astragalus* is the result of many years' labour and careful investigation. The 8 subgenera and 104 sections into which this extensive genus is divided appear to be very satisfactory; but the species (971) are probably very much too numerous, and we miss that comparison with American forms which, considering the very numerous cases of identity or close affinity, is essential for the due appreciation of the N. Asiatic species. Bunge has also published a monograph of the *Heliotropia* of the Mediterraneo-Oriental region in the Bulletin of the Society of Naturalists of Moscow, which continues its annual volumes. The parts recently received continue several of the botanical enumerations already noticed, together with various smaller entomological papers.

IV. GERMANY AND HOLLAND.

Germany, or rather Central Europe from the Rhine to the Carpathians and from the Baltic to the Alps, is, as to the greater part of it, a continuation of that generally uniform but gradually changing biological region which covers the Russian empire. It is not yet affected by those peculiar western races which either stop short of the Rhine and Rhone or only here and there cross these rivers with a few stragglers; the mountains, however, on its southern border show a biological type different from either of those which limit the Russian portion, indicating in many respects, as I observed in 1869, a closer connexion with the Scandinavian and high northern than with the Pyrenean to the west or the Caucasian to the east. The verifying and following up these indications gives a special interest to the study of German races, their variations and affinities. So far as formal specific distinctions are concerned, all plants and animals, with the exception of a few of those whose minute size enables them long to escape observation, may now be considered as well known in Germany as in France and England; and in Germany especially the investigation of anatomical and physiological characters has of late years contributed much to a more correct appreciation of those distinctions and of the natural relations of organic races. But much remains still for the systematic biologist, and especially the zoologist, to accomplish. Among the very numerous Floras of the country, both general and local, there are several which have been worked out with due reference to the vegetation of the immediately surrounding regions; but corresponding complete Faunas do not appear to exist. A few in some branches have been commenced; but in these, as in the numerous papers on more or less extended local zoology, as far as I can perceive, animals, and especially insects, seem to be considered only in respect of the forms they assume within the region treated of, frequently with a very close critical study of variations or races of the lowest grades, but neglecting all comparison with the forms a species may assume or be represented by in adjoining or distant countries.

Germany holds a first rank amongst civilized nations in respect of her biological works in most departments; they probably exceed in bulk those of any other country. Her publishing scientific academies and other associations, her zoological museums and gardens, her botanical herbaria and university gardens, her zoologists and botanists, of world-wide reputation, are far too numerous to be here particularized. She excels all other nations in the patient and

persevering elaboration of minute details, although she must yield to the French in respect of clearness and conciseness of methodical exposition. Her speculative tendencies are well known; and the great impulse given to them since the spread of "Darwinismus" appears to have thrown systematic biology still further into the background; the sad events of the last twelvemonth have also temporarily suspended or greatly interfered with the peaceful course of science. Thus the zoological works contained in the lists I have received are almost all dated in 1868 or 1869, and have been already analyzed in the reports of Wiegmann's 'Archiv' and in the 5th and 6th vols. of the 'Zoological Record,' and the principal ones relating to exotic zoology will have to be referred to further on. In Systematic Botany also but little of importance has been published within the last three years, beyond the great 'Flora Brasiliensis,' which, since the death of Dr. v. Martius, has been actively proceeded with under the direction of Dr. Eichler, and to which I shall recur under the head of South America. Rohrbach has published a carefully worked out conspectus of the difficult genus *Silene*, and, in the 'Linnæa,' a synopsis of Lychnidæ; and Bœckeler, also in the 'Linnæa,' is describing the Cyperacæ of the herbarium of Berlin—a work very unsatisfactory, considering the detail in which it is carried out, as it takes no notice whatever of the numerous published species not there represented, nor of any stations or information relating to those described other than what are supplied by that herbarium. It is not a monograph, but a collection of detached materials for a monograph.

V. SWITZERLAND.

Switzerland comprises the loftiest and most extensive mountain-range of which the biology has been well investigated—the Alps, which have lent their name to characterize the vegetation and other physical features of mountains generally when attaining or approaching to the limits of eternal snows. The relations of this alpine vegetation, both in its general character due to climatological and other physical causes, and in its geographical connexion with other floras, have been frequently the subject of valuable essays, several of which I have mentioned on former occasions; and it is most desirable that the results obtained should be verified by or contrasted with those which might be derived from zoological data; and more particularly by the observation of insects and terrestrial mollusca. As a first step, it is necessary that the plants and animals of the country should be accurately defined and classed in harmony

with those of adjoining regions. This has been done for plants. The Swiss flora has been well worked up both by German and by French botanists; it is included in Koch's Synopsis and some other German Floras. De Candolle and other writers on the French flora had to introduce a large portion of the Swiss vegetation; and the compilers of the rather numerous Swiss Floras and Handbooks* have generally followed either the one or the other, so that there remains but little difficulty in the identification of Swiss botanical races; but here, as elsewhere, methodical Faunas of the country are much in arrear. I have the following notes from M. Humbert of what has been published in this respect during the last three years.

V. Fatio, 'Faune des Vertébrés de la Suisse,' 8vo, vol. i. Mammifères, 1869 (reported on in 'Zoological Record,' vi. p. 4): the second volume, Reptiles, Batrachia, and Fishes, to appear in the course of the present year, the 3rd and 4th vols. (Birds) to follow. "This Fauna is the first which has been published on the Vertebrata of Switzerland. Hitherto there had only been partial and incomplete Catalogues. The species are carefully described; and there are numerous notes on their distribution and habits, from the author's observations made in all the Swiss collections and in the field. There are also interesting historical details upon certain animals which have more or less completely disappeared from Swiss territory, such as the stag, the roebuck, and the wild boar, as also on the mammifers whose remains have been found in recent deposits." G. Stierlin and V. de Gautard, "Fauna Coleopterorum Helvetica," in the Nouveaux Mémoires of the Helvetic Society, xxiii. and xxiv., a catalogue with stations and often limits in altitude, supplementing Heer's 'Fauna

* In the list of publications of the last three years only, sent me by M. A. de Candolle, are the following new Swiss Botanical Handbooks:—J. C. Ducommun, 'Taschenbuch für den schweizerischen Botaniker,' 1 vol. 8vo, of 1024 pages, with some analytical woodcuts: few details on stations. R. T. Simler, 'Botanischer Taschenbegleiter des Alpenclubisten,' 1 vol. 12mo, 4 plates: alpine species only. Tissière (late Canon of St. Bernard, now deceased), 'Guide du Botaniste au Grand St.-Bernard,' 1 vol. 8vo: a catalogue with detailed localities. J. Rhiner, 'Prodrom der Waldstädter Gefässpflanzen,' 1 vol. 8vo: a catalogue with details as to localities. Morthier, 'Flore analytique de la Suisse,' 1 vol. 18mo: imitated from an older German 'Excursions-Flora für die Schweiz,' by A. Gremli. A new (3rd) edition of L. Fischer's 'Flora von Bern' and Fischer-Ooster's 'Rubi Bernenses;' the latter work, together with some contributions to the Swiss Flora of A. Gremli, adding 98 pages to the volumes of Botanical literature we already possess, without advancing a step either in giving us a clear notion of what is a species of Bramble, or in facilitating our naming those we meet with, unless in the precise localities indicated by the several authors.

Coleopterorum Helvetica.' H. Frey's catalogues of and notes on Swiss Microlepidoptera, in the 'Mittheilungen' of the Swiss Entomological Society. P. E. Müller, Note on the Cladocera of the great lakes of Switzerland, from the 'Archives' of the Bibliothèque Universelle, xxxvii. April 1870. "In his excellent memoir on the Monoclea of the neighbourhood of Geneva, Jurine had only described the small crustacea of ponds and swamps. He had not investigated the species which inhabit the Lake of Geneva, and he had also neglected some very interesting forms which are only to be met with in large expanses of water, such as *Bythotrephes longimanus* and *Leptodora hyalina*. M. Mueller points out the differences there are between the Cladocera of the centre of the lakes and those of the margins. The former, which float freely over the lake, have a peculiar stamp, marking also the marine crustacea of open seas; their bodies have an extreme transparency, and they show a great tendency to the development of long and rigid balancing organs. The latter, on the contrary, are little transparent, have stunted forms, and are without balancing or other elongations, which might interfere with their movements amidst solid objects, such as stones and aquatic plants near the shores; most of these littoral species show, moreover, a development of some organ that assists them in moving upon solid bodies. M. Müller finds also a very great connexion between the Cladoceral faunas of Switzerland and Scandinavia."

The Association zoologique du Léman, founded upon the model of the Ray Society, has for its object the publication of monographs relating to the basin of the Léman or Lake of Geneva—that is, the region comprised between Martigny and the Perte du Rhône, with the valleys of the affluents received by the Rhone in this portion of its course. It has been carried on as successfully as could have been expected from a scientific undertaking of this nature, reckoning at the present moment nearly 200 members. It has already published papers by A. Brot on the shells of the family of Naiadæ, with nine plates; by F. Chevrier on the Nyssæ (Hymenoptera); by V. Fatio on the Arvicola, with six plates; by H. Fournier on the Dascillidæ (Coleoptera), with four plates; and is now issuing a more important work, the result of long and patient investigation, G. Lunel's 'Histoire Naturelle des Poissons du Bassin du Léman,' in folio, with twenty plates beautifully executed in chromolithography. Two parts, with eight plates, have already appeared; and the work is in rapid progress. A specimen of the plates, received from M. Humbert, lies on the table of our library. I have also a rather long list

of papers on the zoology of the same district or of the Canton de Vaud, inserted in the Bulletin of the Société Vaudoise of Natural History, and of others on the zoology of other districts, from various other Swiss Transactions, all of which are noticed in our 'Zoological Record,' vols. v. and vi. To these must be added J. Saratz's "Birds of the Upper Engadin," from the 2nd volume of the Bulletin of the Swiss Ornithological Society, 1870. "The valley of the Upper Engadin commences at 1860 metres above the level of the sea, and ends at 1650 metres, where commences the Lower Engadin. The list, therefore, given by M. Saratz includes no point situate below that elevation. He classes the birds of this valley and of the mountains which enclose it into:—1, sedentary birds; 2, birds which breed in the Upper Engadine, but do not spend the winter there; and 3, birds purely of passage. He enumerates 144 species, and gives upon every one notes of its station, times of passage, abundance or rarity, &c."

Meyer-Dür has a short note in the 'Mittheilungen' of the Swiss Entomological Society (iii. 1870) on certain relations observed between the insect-faunas of Central Europe and Buenos Ayres—a question worthy perhaps of some consideration in connexion with the above-mentioned coincidence of a Chilian and East-Mediterranean *Geum*, and a very few other curious instances of identical or closely representative species of plants in the hot dry districts of the East Mediterranean, the central Australian, and the extratropical South-American regions.

Swiss naturalists continue their activity in various branches of biology. E. Claparède's very valuable memoirs on Annelida Chætopoda and on Acarina have been fully reported on in the 'Zoological Record,' as well as Henri de Saussure's entomological papers, which have been continued in the more recently published volumes of the Memoirs of the Société de Physique of Geneva and of the Swiss Entomological Society. In Botany, since I last noticed De Candolle's 'Prodromus,' the 16th volume has been completed by the appearance of the first part, containing two important monographs—that of Urticaceæ, by Weddell, and of Piperaceæ by Casimir de Candolle, together with some small families by A. de Candolle and J. Müller. The social disturbances of the last twelvemonth have much delayed the preparation of the 17th volume, which is to close this great work; but it is hoped that it will now be shortly proceeded with. Of Boissier's 'Flora Orientalis,' mentioned in my Address of 1868, the second volume is now in the printer's hands. Dr. G. Bernouilli, who had resided some time in Central America, has published, in the

Memoirs of the General Helvetic Society (vol. xxiv.), a review of the genus *Theobroma*, after having compared his specimens with those in the herbaria of Kew, Berlin, and Geneva.

VI. ITALY AND THE MEDITERRANEAN REGION.

The biological interest of the Mediterranean Region, which includes southern Europe, the north coast of Africa, and those lands vaguely termed the Levant, is in many respects the opposite of that of the great Russian empire. Extending from the Straits of Gibraltar to the foot of the Caucasus and Lebanon, over 40 to 45 degrees of longitude, by 10 to 12 degrees of latitude, from the southern declivities of the Pyrenees, of the Alps, the Scardus, and the Balkan, to the African shores, it shows, indeed, a certain uniformity of vegetation through the whole of this length and breadth; but it has evidently been the scene of great and frequent successive geological convulsions and disturbances, which, whilst they have wholly or partially destroyed some of the races most numerous in individuals, have at the same time so broken up the surface of the earth as to afford great facilities for the preservation or isolation of others represented by a comparatively small number of individuals. The consequence is that there is probably no portion of the northern hemisphere in the Old World, of equal extent, where the species altogether, and especially the endemic ones, are more numerous, none, I believe, which contains so many *dissevered* species (those which occupy several limited areas far distant from each other), and certainly none where there are so many strictly local races, species or even genera, occupying in few or numerous individuals single stations limited sometimes to less than a mile. In all these respects the Mediterranean region far exceeds, absolutely as well as relatively, the great Russian region, which has three times its length and twice its breadth; it presents also, perhaps, almost as great a contrast to a more southern tract of uniform vegetation extending across the drier portion of Africa and Arabia as far as Scinde. This diversified endemic and local character exemplified in the plants of the Mediterranean region has, as far as I can learn, been observed also in insects.

Of the three great European peninsulas which form the principal portion of the region, the Italian is the narrowest and has the least of individual character in its biology; but it is the most central one, and, including its continental base with the declivity of the Alps, may be taken as a fair type of the region generally; it is also by far the best-known. Italy was the first amongst European nations

to acquire a name in the pursuit of natural science after emerging from the barbarism of the middle ages; and although she has since been more devoted to art, and has allowed several of the more northern states far to outstrip her in science, she has still, amidst all her vicissitudes, produced a fair share of eminent physiologists as well as systematic zoologists and botanists; and within the last few years the cultivation of biology appears to have received a fresh impulse. It is only to be hoped that it may not be seriously checked by local and political intrigues, which appear to have succeeded, in one instance at least, in conferring an important botanical post on the least competent of the several candidates. Amongst the various publishing academies and associations mentioned in my Address of 1865, the Italian Society of Natural Sciences at Milan contains a considerable number of papers on Italian zoology; and a few others in zoology and palæontology are scattered over the publications of the Academies of Turin and Venice and of the Technical Institute of Palermo. From the lists I have received, there appear to have been recent catalogues of Sicilian and Modenese Birds by Doderlein in the Palermo Journal, of Italian Araneida and Modenese Fishes by Canestrini in the Milanese Transactions, and of Italian Diptera, commenced by Rondani in the Bulletin of the Italian Entomological Society. Malacology, so peculiarly important in the study of the physical history of the Mediterranean region, has produced numerous papers, chiefly in the Milanese Transactions, and in Gentiluomo's 'Bullettino Malacologico' and 'Biblioteca Malacologica,' published at Pisa. I also learn that at the time of the decease of the late Prof. Paolo Savi, in the beginning of April, the manuscript of his 'Ornitologia Italiana' was complete, and had just been placed in the printer's hands.

In Botany, Parlatore's elaborate 'Flora Italiana' has continued to make slow progress. We have received up to the 2nd part of the 4th volume, reaching as far upward as Euphorbiaceæ, having commenced with the lower orders. The old Journal of Botany ceased with the year 1847, as I presumed to have been the case when I mentioned it in 1865, and has since been replaced by a 'Nuovo Giornale Botanico Italiano,' which continues, with tolerable regularity, issuing four parts in the year, the last received being the 2nd of the third volume. The most valuable of the systematic papers it contains are Beccari's descriptions of some of his Bornean collections. Delpino, well known for his interesting dichogamic observations, as well as for some rather imaginative speculations, has also contributed to systematic botany a monograph of Maregraaviaceæ, but,

unfortunately, without sufficient command of materials for the compilation of a useful history of that small but difficult group, and with a useless imposition of new names to forms which he thinks may have been already published, but has not the means of verifying. De Notaris, under the auspices of the municipality of Genoa, has published a synopsis of Italian Bryology, forming a separate octavo volume of considerable bulk.

Of the other two great European peninsulas I have little to say, notwithstanding their great comparative biological importance. The Western or Iberian peninsula is the main centre of that remarkable Western flora to which I specially alluded in 1869, and which, more perhaps than any other, requires comparison with entomological and other faunas. But Spain is sadly in arrear in her pursuit of science. With great promise in the latter half of the last century, and certainly the country of many eminent naturalists, especially botanists, she has now for so long been subject to chronic pronunciamientos that she leaves the natural riches of her soil to be investigated by foreigners. Willkomm and Lange's 'Prodrômus Floræ Hispanicæ,' which, when I last mentioned it, was in danger of remaining a fragment, has since been continued, and, it is hoped, will shortly be completed by the publication of one more part. I have no notes on any recent zoological papers beyond Steindachner's Reports on his Ichthyological tour in Spain and Portugal, and the Catalogues of the Zoological Museum of Lisbon publishing by the Lisbon Academy of Sciences. The Eastern peninsula, Turkey and Greece, with the exception of some slight attempts at Athens, has no endemic biological literature, and, with its present very unsatisfactory social state, affords little attraction to foreign visitors. The Levant, in respect of botany at least, has been much more fully investigated; but there, as in Turkey, much yet remains to be done; and pending the issue of Boissier's second volume already mentioned, I know of nothing of any importance in the biology of the East Mediterranean region as having been worked out within the last two or three years. As an hiatus, however, and yet a link between the Indian and the European floras and faunas, it will amply repay the study to be bestowed upon it by future naturalists.

VII. FRANCE.

France, without any special endemic character, unites within her limits portions of several biological regions, thus requiring from her naturalists the study of all the European floras and faunas in order rightly to understand her own. The greater part of her surface

constitutes the western extremity of that great Russo-European tract I have above commented upon, its flora, and probably also its fauna, here blending with the West-European type, which spreads more or less over it from the Iberian peninsula. To the south-east she has an end of the Swiss Alps, connected to a certain degree with the Pyrenees to the south-west by the chain of the Cevennes, but at an elevation too low, and which has probably always been too low, for the interchange of the truly alpine forms of those two lofty ranges. South of the Cevennes she includes a portion of the great Mediterranean region; and the marine productions of her coasts are those of three different aquatic regions—the North Sea, the Atlantic, and the Mediterranean. The few endemic or local races she may possess appear to be on those southern declivities which bound the Mediterranean region; and if the volcanic elevations of Central France have a special interest, it is more from the absence of many species common at similar altitudes in the mountains to the east or to the south-west, than from the presence of peculiar races not of the lowest grades, with the exception, perhaps, of a very few species now rare, and which may prove to be the lingering remains of expiring races.

With so many natural advantages, French science, represented during the last two centuries by as great, if not a greater number of eminent men than any other country, has long felt the necessity of a thorough investigation of the biological productions of her territory. The French Floras, both general and local, are now numerous, and some of them excellent. The geographical distribution of plants in France has also been the subject of various essays as well as separate works. It is only to be regretted that in the Floras themselves the instructive practice of indicating under each species its extra-Gallican distribution has not yet been adopted. In zoology, no general fauna has been attempted since De Blainville's, which was never completed; and none is believed to be even in contemplation; but I have a long list of partial Faunas and memoirs on the animals of various classes of several French departments; and Rey and Mulsant are publishing, in the Transactions of two Lyons Societies, detailed monographs of all French Coleoptera.

The progress of French naturalists in Biology in general up to 1867 has been fully detailed as to zoology by Milne-Edwards, in his 'Rapport sur les Progrès de la Zoologie en France;' and as to Systematic Botany by Ad. Brongniart in his 'Rapport sur les Progrès de la Botanique Phytographique.' The recent progress as to both branches, as well as in regard to other natural sciences, has also

been reviewed by M. Emile Blanchard in his annual Addresses to the Meetings of the Delegates of French Scientific Societies, held every April at the Sorbonne from 1865 to 1870. The Société Botanique de France had also up to that time been active, and the publication of its proceedings brought down nearly to the latest meetings. I am compelled, however, for want of time, to defer some details I had contemplated relating to the recent labours of French biologists; but I cannot refrain from inserting the following note on a work mentioned only, but not analyzed, in the last volume of the 'Zoological Record,' obligingly communicated to me with other memoranda by Professor Deshayes, whilst slowly recovering from a severe illness contracted during the German siege:—"In Mollusca we have also to regret that we have no complete work embracing the whole of this important branch of the animal kingdom. It is true that we make use of numerous works published in England, amongst which several are excellent, such as those of Forbes and Hanley, Gwyn Jeffreys, &c. Nevertheless I have to point out to you an excellent work published in 1869 by M. Petit de la Saussaye. The author, a very able and scientific conchologist, is unfortunately just dead. He has had the advantage of preparing a general catalogue of testaceous Mollusca of the European Seas, possessing in his own collection nearly the whole of the species inserted, and of having received direct from the authors named specimens of the species foreign to the French coasts. This work is divided into two parts. The first is devoted to the methodical and synonymical catalogue of the species, amounting to 1150. In the second part, these species are distributed geographically into seven zones, starting from the most northern and ending with the hot regions of the Mediterranean. These zones are thus distinguished:—1, the polar zone; 2, the boreal zone; 3, the British zone; 4, the Celtic zone; 5, the Lusitanian zone; 6, the Mediterranean zone; and 7, the Algerian zone. Some years since it would have been impossible for M. Petit to have established the fifth zone, for that nothing, literally nothing, was known of the malacological fauna of Spain. Its seas were until 1867 less known than those of New Holland or California. It was only in that year that Hidalgo published a well-drawn-up synonymic catalogue in Crosse and Fischer's 'Journal de Conchyliologie.'"

VIII. BRITAIN.

The British Isles have less even than France of an endemic character in respect of biology. They form, as it were, an outlying

portion of regions already mentioned, the greater part, as in the case of France, belonging to the extreme end of the great Russo-European tract. Like France, also, they partake, although in a reduced degree, of that Western type which extends upwards from the Iberian peninsula. They are, however, completely severed from the Mediterranean as from the Alpine regions; their mountain-vegetation, and, as far as I can learn, their mountain-zoology, is Scandinavian; and if it shows any connexion with southern ranges, it is rather with the Pyrenees than with the Alps. The chief distinctive character of Britain is derived from her insular position, which acts as a check upon the passive immigration of races, and is one cause of the comparative poverty of her fauna and flora; the isolation, on the other hand, may not be ancient enough or complete enough for the production and preservation of endemic forms. As far as we know, there is not in phænogamic botany, nor in any of the orders of animals in which the question has been sufficiently considered, a single endemic British race of a grade high enough to be qualified as a species in the Linnæan sense. How far that may be the case with the lower cryptogams cannot at present be determined; there is still much difficulty in establishing species upon natural affinities, and (in some Lichens and Fungi for instance) much confusion between phases of individual life and real genera and species remains to be cleared up. The study of our neighbours' faunas and floras is therefore necessary to make us fully acquainted with the animals and plants we have, and useful in showing us what we have not, but should have had were it not for causes which require investigation—such, for instance, as plants like *Salvia pratensis*, a common European species to be met with in abundance the moment we cross the Channel, but either absent from or confined to single localities in England.

There is no country, however, in which the native flora and fauna have been so long and so steadily the subject of close investigation as our own, nor where they continue to be worked out in detail by so numerous a staff of observers. To the Floras we possess a valuable addition has been made within the last twelvemonth in J. D. Hooker's 'Students' Flora of the British Isles'—the best we have for the purposes of the teacher, and in which the careful notation of the general distribution of each species is a great improvement on our older standard class-books. H. C. Watson's recently completed 'Compendium of the Cybele Britannica' treats of the geographical relations of our plants with that accuracy of detail which characterizes all his works. In zoology, although we

may not have compact synoptical Faunas corresponding with our Floras in all branches of the animal kingdom, the series of works on British Vertebrata published by Van Voorst are a better and more complete account of our indigenous races than any Continental state can boast of; and I observe with much pleasure that, in the new edition announced of the 'British Birds,' Mr. Newton proposes specially to follow out the determination of their geographical range, upon which Mr. Yarrell had bestowed so much pains. With regard to our Mollusca, we have been very fortunate. Forbes and Hanley's costly work, published by the Ray Society, has been followed by Gwyn Jeffreys's 'British Conchology,' the great merits of which as a Malacological Fauna of Britain have been fully acknowledged abroad as well as at home. The present geographical as well as the fossil range of the species is specially attended to; and the only thing missed is, perhaps, a general synoptical view of the characters of the classes, families, and genera into which the species are distributed. The Ray Society series comprises also several most valuable works on the lower orders of British animals; but the entomological fauna of our country, especially in relation to the insects of the adjoining continent, notwithstanding the numerous able naturalists who devote themselves to its study, appears to be somewhat in arrear. In answer to my query as to works where our insects are compared with those of other countries, I received from our Secretary, Mr. Stainton, the following reply:—"The questions you have put to me with reference to our entomological literature are very important; they, however, painfully call my attention to the necessarily unsatisfactory nature of my replies. Wollaston's 'Coleoptera Hesperidum' * is the only separate work to which I can direct your attention as giving the fauna of a particular district with the geographical range of such of the species as are likewise found elsewhere. R. M'Lachlan, who in 1865 had published (Trans. Ent. Soc. ser. 3, v.) a Monograph of the British Caddis-flies, gave in 1868 (Trans. Ent. Soc. for 1868) a Monograph of the British Neuroptera Planipenna; but little is there said of the European range of our species. In 1867 (Entom. Monthly Mag. iii.) Mr. M'Lachlan, who is one of our most philosophical writers, gave a Monograph of the British Psocidæ; and he there says, with reference even to their distribution in our own country, 'As a rule, I have not mentioned special localities; these insects have been so little collected that an enumeration here of known or recorded localities would probably appear ridiculous in a few years.' The

* Referred to in my Address of 1869.

Rev. T. A. Marshall has given (*Entom. Monthly Mag.* i. to iii.) an Essay towards a knowledge of the British Homoptera, in which occasionally allusion is made to the European distribution of our British species.

“The position of the Insect-fauna of Britain may be thus stated:—The late J. F. Stephens commenced in 1827 a systematic descriptive work of all the orders of British Insects as ‘Illustrations of British Entomology;’ it ceased to appear after 1835, until a supplementary volume came out in 1846. The Lepidoptera, Coleoptera, Orthoptera, Neuroptera were wholly, the Hymenoptera partly, done, the Hemiptera and Diptera altogether left out. In 1839 Mr. Stephens published, in a more compendious form, a ‘Manual of British Beetles.’ In 1849 an attempt was made to supply the gaps in the British Entomology left by Stephens, and a scheme of a series of volumes called ‘Insecta Britannica’ was elaborated, in which Mr. F. Walker was to undertake the Diptera, Mr. W. S. Dallas the Hemiptera, and, great progress having been made in our knowledge of the smaller moths since 1835, I undertook to write a volume on the Tineina. This scheme was so far carried out, that three volumes on the British Diptera by Mr. F. Walker (assisted by the late A. H. Haliday) appeared in 1851, 1852, and 1856, and my volume on the British Tineina in 1854. In 1859 another great group of the smaller moths was described by S. J. Wilkinson, in a volume entitled ‘The British Tortrices.’ The British Hemiptera not having been done by Mr. Dallas, were undertaken by Messrs. Douglas and Scott for the Ray Society; and in 1865 a 4to volume was issued, containing the Hemiptera Heteroptera, leaving the Homoptera for a second volume, still in progress. Even in this elaborate work little or nothing is said of the geographical distribution out of Britain of our British species. The same remark will apply to the late J. F. Dawson’s ‘Geodephaga Britannica,’ published in 1854, to Westwood’s ‘Butterflies of Great Britain,’ published in 1855, and to E. Newman’s ‘Illustrated Natural History of British Moths,’ published in 1869.

“I believe I do not at all exaggerate if I say that for many years Entomology was pursued in this country with an insularity and a narrow-mindedness of which a botanist can scarcely form a conception. The system of only collecting British Insects was pursued to such an extent that it was almost a crime to have a non-British insect in one’s possession: if accidentally placed in one’s cabinet it might depreciate the value of the entire collection; for Mr. Samuel Stevens can assure you that the value of the specimens depends very

much upon their being indubitably and unmistakably British. A specimen caught in Kent which would fetch £2 would not be worth 2 shillings if caught in Normandy. I satirized this practice several years since in the 'Entomologist's Weekly Intelligencer' (vol. v. and 1858, articles 'Jeddo' and 'Insularity'); but it is yet far from extinct."

Perfectly concurring in Mr. Stainton's observations in the last paragraph, I would however add that there are purposes for which a local or geographical collection distinct from the general one may be of great use; and such a collection would be much impaired by the introduction of stray foreign specimens. In a local museum, a separate room devoted exclusively to the productions of the locality is very instructive with reference to the history of that locality; and I have seen several such spoiled by the admission of exotic specimens, giving the visitor false impressions which it takes time to remove. But it is never from such an exclusive collection that the fauna or flora of the district can be satisfactorily worked out, or that any branch of zoology or botany can be successfully taught.

Mr. Stainton adds, "It has been suggested to me that those who have critically studied the distinctions between closely allied species have rarely the time to work out in addition their geographical range, and that those who might work up the latter subject might fail in their good intentions for want of a proper knowledge of species." Upon this I would observe that, in the due appreciation of a species (of its limits and connexions), its geographical range and the various forms it assumes in different parts of its area are an essential element; and it appears to me that the neglect of this and other general characters is one reason why many able naturalists, who have devoted their lives to the critical distinction of races of the lowest grades unduly raised to the rank of species, have really contributed so little to any science but that of sorting and naming collections. On the other hand, the study of geographical range without a proper knowledge of species is little more than pure speculation. Division of labour carried too far tends to narrow the mind, and rather to delay than to advance the healthy progress of science.

Mr. Stainton informs me that "there has just appeared a *Monograph of the Ephemeridæ*, by the Rev. A. E. Eaton (Trans. Entom. Soc. 1871), treating of these insects throughout the globe; and when any species are noticed which occur in this country, their entire geographical range is noticed. It is altogether a valuable paper, on account of the thoroughness with which it seems to be done."

Since I last noticed our biological publications two valuable and beautifully illustrated but costly Ornithological works, Selater and Salvin's 'Exotic Ornithology' and Sharpe's 'Monograph of the Alcedinidæ,' have been completed, and various Memoirs by Flower, Mivart, Parker, and others have considerably advanced our knowledge of the comparative anatomy of various groups of Mammalia. In our own country also, as well as on the Continent, the biology of various distant lands has continued to be worked out in memoirs or independent publications, which I had contemplated noticing in succession; but time obliges me now to stop, and defer to a future occasion the compilation of the notes I had collected on North American, Australian, and other Monographs, Faunas, and Floras.

The Secretary reported that the following Members had died, or their deaths been ascertained, since the last Anniversary:—

FELLOWS.

Thomas Anderson, M.D.	Rev. Charles Hotham.
R. Parr Bamber, Esq.	Richard Peek, LL.D.
Nathaniel Buckley, M.D.	Charles A. Robinson, Esq.
Robert Chambers, Esq.	J. G. Veitch, Esq.
Archdeacon William Hale, M.A.	James Yates, Esq.
A. H. Haliday, Esq.	

FOREIGN MEMBERS.

Moritz Herold.	F. A. W. Miquel, M.D.
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ASSOCIATE.

Henry Denny.

The Secretary also announced that nineteen Fellows and one Foreign Member had been elected since the last Anniversary.

At the Election which subsequently took place, George Bentham, Esq., was re-elected President; William Wilson Saunders, Esq., Treasurer; and Frederick Currey, Esq., and H. T. Stainton, Esq., Secretaries. The following five Fellows were elected into the Council, in the room of others going out:—viz. A. W. Bennett, Esq., F. D. C. Godman, Esq., M. A. Lawson, Esq., S. J. A. Salter, Esq., the Rev. Thomas Wiltshire.

Mr. Daniel Hanbury, on the part of the Auditors of the Treasurer's Accounts, read the Balance-sheet, by which it appeared that the total