box, termed an "analyzer," contains the series of evaporating chambers, each communicating with the one below by means of a valved tube, which allows fluid to escape from the upper to the lower chamber only, and having the dividing partition of each chamber perforated with fine apertures, to allow the steam which is admitted from below to pass from chamber to chamber through the shallow layer of wash of each. A safety or escape valve is also fitted to each chamber. The already heated wash enters the uppermost of these chambers in a continuous regulated stream, is gradually deprived of its alcohol by the steam as it passes from chamber to chamber, and at last escapes into the lower large receiver, from which it flows off after attaining a certain depth. The third part of the apparatus also consists of a square upright box, termed a "condenser," divided into compartments by means of finely perforated plates, and in each chamber is a link of the tube which carries the cold wash onwards to supply the evaporating chambers just described. The alcoholic vapours escaping from the uppermost of the evaporating chambers are carried by pipes to the lowermost of these chambers, and are partly condensed by each successive chamber being colder than the one below it, in consequence of the wash entering the pipes from above, and only getting gradually heated by contact with the alcoholic vapour as it advances from chamber to chamber. As in the lowest of these chambers the heat is greatest, the alcoholic vapour or the condensed spirit contains a large amount of water; but as the chambers are successively cooler, the alcoholic vapour and condensed spirit at last arrive at a temperature only sufficient to convert spirit of the strength wished into vapour, and by an adaptation of valves, the substitution of an impervious partition for the perforated plate, and the admission of the alcoholic vapour into the chambers cooled by the passage of the cold wash in its contained pipes, that spirituous vapour is condensed, and the spirit is drawn off at one operation, of the very strength which it ought to have, and of the utmost purity.

Flat-bottomed and fire-heated stills are considered the best for the distillation of malt spirit, as by them the flavour is preserved. Coffey's still, on the other hand, is the best for the distillation of grain spirit, as by it a spirit is obtained almost entirely destitute of flavour, and of a strength varying from 55 to 70 over proof. Spirit produced of this high strength evaporates at such a low temperature that scarcely any of the volatile oils on which the peculiar flavour of spirits depends are evaporated with it, hence the reason why it is not adapted for the distillation of malt whisky, which requires a certain amount of these oils to give it its requisite flavour. The spirit produced by Coffey's still is, therefore, chiefly used for making gin and factitious brandy by the rectifiers, or for being mixed with malt whiskies by the wholesale dealers.

As the preparation of alcoholic spirit is the most important industry in which the operation of distillation occupies a prominent place, the establishments in which the manufacture is conducted are known as distilleries. But there are many other important industries in which distillation is an essential feature, being in them employed either for the separation, purification, or concentration of various products. A large proportion of the essential oils are, for example, obtained by the distillation of the substances containing them from water or a mixture of salt and water. The treatment of other bodies in which distillation plays a part will be found under their respective headings.

(W. D.—J. PA.)

DISTRESS is one of the few cases in which the law still permits an injured person to take his remedy into his own hands. Other instances mentioned in the text-books are self-defence in the case of a personal assault, the resciture of property wrongfully taken away, the abatement of nuisances, &c. Distress differs from these as being a remedy for what is really a breach of contract, and it is the only case of the kind in which such a remedy is given. It is the right which the landlord has of seizing the personal chattels of his tenant for non-payment of rent Cattle *damage feasant* (doing damage or trespassing upon a neighbour's land) may also be *distrained*, *i.e.*, may be detained until satisfaction be rendered for the injury they have done. The cattle or other animals thus distrained are a mere pledge in the hands of the injured person, who has only power to retain them until the owner appear to make satisfaction for the mischief they have done. Distress for rent was also at one time regarded as a mere pledge or security; but the remedy, having been found to be speedy and efficacious, was rendered more perfect by enactments allowing the thing taken to be sold. Blackstone notes that the law of distresses in this respect "has been greatly altered within a few years last past." The legislature, in fact, converted an ancient right of personal redress into a powerful remedy for the exclusive benefit of a single class of creditors, viz., landlords. Now that the relation of landlord and tenant in England has come to be regarded as purely a matter of contract, the language of the law-books seems to be singularly inappropriate. The defaulting tenant is a "wrong-doer," the landlord is the "injured party;" any attempt to defeat the landlord's remedy by carrying off distrainable goods is denounced as "fraudulent and knavish." The operation of the law has, as we shall point out, been mitigated in one important respect by a recent Act, but it still remains an almost unique specimen of one-sided legislation.

At common law distress was said to be incident to *rent service*, and by particular reservation to rent charges; but by 4 Geo. II. c. 28 it was extended to *rent seck*, *rents of assize*, and chief rents (see RENT.) It is therefore a general remedy for rent certain in arrear. All personal chattels are distrainable with the following exceptions:—1, things in which there can be no property, as animals *ferae naturae*; 2, things in actual use; 3, things delivered to a person following a public trade, as a horse sent to be shoed, &c.; 4, things already in the custody of the law; 5, money, unless placed in a sealed bag; 6, things which cannot be restored in as good a plight as when distrained; 7, fixtures; 8, beasts of the plough and instruments of husbandry; 9, instruments of a man's trade or profession. These exceptions, it will be seen, imply that the thing distrained is to be held as a pledge merely—not to be sold. They also imply that in general any chattels found on the land in question are to be available for the benefit of the landlord, whether they belong to the tenant or not. This principle worked with peculiar harshness in the case of lodgers, whose goods might be seized and sold for the payment of the rent due by their landlord to his superior landlord. Now, however, by the Lodgers' Goods Protection Act (34 and 35 Vict. c. 79), where a lodger's goods have been seized by the superior landlord the lodger may serve him with a notice stating that the intermediate landlord has no interest in the property seized, but that it is the property or in the lawful possession of the lodger, and setting forth the amount of the rent due by the lodger to his immediate landlord. On payment or tender of such rent the landlord cannot proceed with the distress against the goods in question. And originally the landlord could only seize things actually on the premises, so that the remedy might be defeated by the things being taken away. But by 9 Anne c. 14, and 11 Geo. II. c. 19, he may follow things fraudulently or clandestinely removed off the premises within thirty days after their removal, unless they have been in the meantime *bona fide* sold for a valuable consideration.

The sixth exception mentioned above was held to extend to sheaves of corn; but by 2 Will. and Mary c. 5, corn, when reaped, as well as hay, was made subject to distress.

Excessive or disproportionate distress exposes the distrainer to an action, and any irregularity formerly made the proceedings void *ab initio*, so that the remedy was attended with considerable risk. The statute 11 Geo. II. c. 19, before alluded to, in the interests of landlords, protected distresses for *rent* from the consequences of irregularity. In all cases of distress for rent, if the owner do not within five days replevy the same with sufficient security, the thing distrained may be sold towards satisfaction of the rent and charges, and the surplus, if any, must be returned to the owner. To "replevy" is when the person distrained upon applies to the proper authority (the registrar of the county court) to have the thing returned to his own possession, on giving security to try the right of taking it in an action of replevin.

Duties and penalties imposed by Act of Parliament are sometimes enforced by distress.

DISTRIBUTION

THE subject specially discussed under this heading is the Distribution of Life, Animal and Vegetable, in Space and Time.

So long as each species of organism was supposed to have had an independent origin, the place it occupied on the earth's surface or the epoch where it first appeared had little significance. It was, indeed, perceived that the organization and constitution of each animal or plant must be adapted to the physical conditions in which it was placed; but this consideration only accounted for a few of the broader features of distribution, while the great body of the facts, their countless anomalies and curious details, remained wholly inexplicable. But the theory of evolution and gradual development of organic forms by descent and variation (some form of which is now universally accepted by men of science) completely changes the aspect of the question and invests the facts of distribution with special importance. The *time* when a group or a species first appeared, the *place* of its origin, and the *area* it now occupies upon the earth, become essential portions of the history of the universe. The course of study initiated and so largely developed by Mr Darwin has now shown us the marvellous interdependence of every part of nature. Not only is each organism necessarily related to and affected by all things, living and dead, that surround it, but every detail of form and structure, of colour, food, and habits, must—it is now held—have been developed in harmony with, and to a great extent as a result of, the organic and inorganic environments. Distribution becomes, therefore, as essential a part of the science of life as anatomy or physiology. It shows us, as it were, the form and structure of the life of the world considered as one vast organism, and it enables us to comprehend, however imperfectly, the processes of development and variation during past ages which have resulted in the actual state of things. It thus affords one of the best tests of the truth of our theories of development; because, the countless facts presented by the distribution of living things in present and past time must be explicable in accordance with any true theory, or at least must never directly contradict it.

From these indications of the scope and bearing of the subject, it will be seen that its full and adequate treatment would require volumes, and would necessarily involve an amount of details only suited to specialists in the various branches of natural history. All that can be attempted here is to give such a general sketch of the whole subject as to place the reader in possession of the main results arrived at, and enable him to comprehend the bearing of the more detailed information he may meet with elsewhere.

Arrangement of the Subject.—The three great heads under which the various matters connected with distribution may be classed are—1st, the geographical distribution of living organisms; 2d, the geographical distribution of extinct organisms; and 3d, the geological succession of the chief forms of life. Owing, however, to the fact that the study of animals and of plants form very distinct sciences, and that there are special peculiarities in the phenomena presented by each which require to be carefully discriminated, it is found to be necessary to make a primary division of the subject into the distribution of animals and of plants respectively.

DISTRIBUTION OF ANIMALS.

The distribution of living animals in space naturally forms the first division of our subject, both because the phenomena are simpler and better known, and because it puts before us the main problems and difficulties to the solution of which the other divisions furnish the key. Animals may be roughly divided into two great series, broadly distinguished as regards their mode of life—the terrestrial and the aquatic; and for the purpose of our present study these divisions are of primary importance, because that element which limits the range of the one class offers a free passage to the migrations of the other, and *vice versa*. The first series is by far the most important. It is the best known, and includes almost all the higher animals; while the variety and interest of the various land divisions of the globe are far greater than in the case of that portion of its surface covered by water. We shall therefore consider first, and with a greater amount of detail, the distribution of land animals, including among them the fresh-water forms whose range is limited by the same general conditions.

The Geographical Distribution of Land Animals.

As soon as we begin to examine into the distribution of animals over the land surface of the globe, we meet with two very distinct and sometimes conflicting classes of facts, which may be conveniently grouped as *climatal* and *geographical* distribution. The first is the most obvious, and was long considered to be the most essential, since we find that not only many species, as the polar bear and musk sheep, are strictly limited to cold countries, and others, as the tapir, to warm, but that entire groups, as the sheep on the one hand and the trogons on the other, seem almost equally dependent on temperature. But when we come to compare the productions of the several continents, we find a set of differences in which climate appears to play no part. Thus, almost the whole of the warblers (*Sylviidæ*) of Europe and North Asia are absent in similar climates in North America, their place being taken by a totally distinct family, the wood-warblers (*Mniotiltidæ*); the ant-eaters, sloths, and tapirs of tropical America are replaced in tropical Africa by aard-varks (*Orycteropus*), lemurs, and hippopotami; while islands like Borneo and New Guinea, situated in the same ocean not very far apart, and whose climates and physical conditions are, as nearly as possible, identical, are yet as radically different in their chief forms of animal life as are remote countries situated respectively in the cold and tropi-

cal zones. It is evident then, that although climate has a certain amount of influence on the distribution of animal forms, yet geographical conditions are far more important. There is reason to believe that the direct action of climate on animal life is far less effective than its indirect action through the limitation of the variety and quantity of vegetable and insect food; whereas geographical isolation has led to diversity of type by its influence on development during successive ages, as pointed out by Mr Darwin (*Origin of Species*, 6th ed. p. 81, 83.) It follows that zoological regions, or those primary divisions of the earth characterized by distinct assemblages of animals, will, for the most part, coincide with natural geographical divisions. They do not, however, conform to the actual divisions of our geographies, because these are often political or ethnographical, rather than physical—as in the separation of Europe from Asia. In another case, the coincidence of a mountain chain (the Himalayas) and the plateau of Thibet, with the demarcation of the tropical and temperate zones, forms a zoological division across a continent almost as complete as would be effected by a considerable extent of ocean.

Vertical Distribution of Animals.—Besides the horizontal distribution dependent on the various causes just indicated, the range of animals is more or less determined by the altitude of the land surface above, or its depth below the sea-level. As we ascend lofty mountains, the forms of life change in a manner somewhat analogous to the changes observed in passing from a warm to a cold country. This change is, however, far less observable in animals than in plants; and it is so unequal in its action, and can so frequently be traced to mere change of climate and deficiency of food, that it must rank as a phenomenon of secondary importance. Vertical distribution among animals will be found in most cases to affect species rather than generic or family groups, and to involve in each case a mass of local details which can hardly be introduced in a general sketch of the whole subject of distribution. The same remarks apply to the bathymetrical zones of marine life. Many groups are confined to tidal, or shallow, or deeper waters; but these differences of habit are hardly "geographical," but involve details, suited rather to the special study of individual groups than to such a general outline of the distribution of the animal kingdom as we are here attempting to lay before our readers.

Powers of Dispersal of Animals.—Animals differ greatly in their powers of dispersal or migration; and this is an important element in determining the causes of their actual distribution. Mammalia as a class are more limited in this respect than birds; because the former have no means of passing over seas and oceans, or, with few exceptions, over lofty mountains or arid deserts, all of which when of moderate width can be easily traversed by many birds. Reptiles in their adult state are almost as restricted in their powers of dispersal as mammals, but most of them being oviparous, their eggs may be floated on drift wood over seas and straits, or even, in rare cases, be carried by birds; whereas the young of mammalia are for some time wholly dependent on their parents. Amphibia and fresh-water fishes have yet another advantage, that many of them can endure great cold, and their ova may sometimes be frozen without injury. Thus floating ice becomes an important agent in their dispersal, and enables us to account for the curious fact that their distribution often differs in a remarkable manner from that of the three higher classes of vertebrates. When we come to insects, we find the power of dispersal (as regards land animals) at a maximum; for not only can they travel by almost every mode available to other groups, but their small size, low specific gravity, and (in many cases) great tenacity of life, give them altogether exceptional advantages in this respect. They are easily carried for great distances through the air by gales and storms; and there is evidence to show that many remote islands have been thus stocked, and that many wide-spread groups owe their extensive range to this cause. Others can float uninjured for many days at sea; while their eggs or larvæ, inclosed in crevices of tree-trunks or concealed under bark, may be carried for hundreds or even thousands of miles by surface currents across extensive seas (Wallace, *Geographical Distribution of Animals*, vol. i. pp. 32, 209–214). The fact, then, that these small creatures have often a more extensive range, and present greater anomalies in their distribution, than larger animals, is only what we might expect; and if we keep their unusual powers of dispersal ever present to our minds, we shall be able to account for most of the anomalies they present, and thus bring them under the same general classification of the phenomena of distribution which is most serviceable in studying the history of the higher animals.

But the actual power of dispersal is by no means the only factor in determining the distribution of a species or a group. It is no use to bring a creature to a new country if it cannot live and maintain itself there. Whether it can do so depends upon many causes. It must be able to adapt itself to a different climate, and generally to different physical conditions; it must be able to live upon whatever food it may find in its new abode; and, most important of all, it must be able to defend itself against new kinds of enemies and to live in successful competition with allied organisms which are already in possession of the soil.

Wide-spread and Local Groups.—There is much reason to believe that the last-mentioned condition is the most difficult for an intruder to fulfil, and that a large proportion of the immigrants which from any cause arrive in a new country, are unable to maintain themselves in it, not because the country itself is not well adapted to their wants, but solely because it is already occupied by other creatures somewhat better adapted to all the surrounding conditions. Hence arise the phenomena of wide-spread or dominant species, and others which are exceedingly local and often rare, that is, consisting of but a small group of individuals. The former are best adapted to the entire environment, and are generally increasing their numbers and area of distribution; the latter are less perfectly adapted, and probably diminishing in numbers and on the road to final extinction. The power of adaptation seems, generally speaking, to be in an inverse ratio to the power of dispersal. The larger mammalia and many birds are capable of enduring a great variety of climates, and even of maintaining themselves in many new countries in competition with the native inhabitants. Thus horses and cattle from the Old World have run wild and greatly multiplied in both North and South America, and are probably capable of existing in any country where there is a sufficiency of open uncultivated land. Insects, on the other hand, are often dependent on some one kind of vegetable food, are especially liable to injuries by climate, and unless very numerous would be liable to be at once exterminated by their various enemies.

Barriers which Limit the Distribution of Animals.—These are of many kinds, and affect the several groups in unequal degrees. The nature of the vegetation alone determines the range of a number of animals. Deserts, marshes, open plains, and especially forests, have each their peculiar inhabitants which can hardly stray far beyond their limits. This is particularly the case with the tropical forests, whose perennial foliage and almost perennial succession of flowers and fruits supply the wants of an immense number of peculiar forms of life. These forests are, in fact, the home

of all that is most characteristic of the tropics, and their limits form the dividing lines between very distinct faunas. Rivers, when very large, also determine the range of many species, but this is probably because their valleys have been once arms of the sea separating districts with somewhat different faunas. Mountains, when rising to a great height in unbroken ranges, form an impassable barrier to many groups; but their geological age is also an important factor, and they are seldom so ancient and so continuous as to form absolute barriers. Climate, whether determined by latitude or by elevation above the sea, is also a very effective barrier, though probably its action is indirect, and is determined by its influence on vegetation, and by bringing diverse groups into competition. The limits of the tropical and temperate zones, generally marked out by more or less extensive deserts, form the boundary between regions or sub-regions all round the globe. Oceans are, however, by far the most important barriers; and this is due not only to their great extent and general impassability to land animals, but also to their enormous antiquity, so that for countless ages they have separated the faunas of remote continents from each other.

In accordance with these principles, it is found, that continents separated by the widest and deepest oceans differ most radically in the entire series of their animals; while those which are less completely separated, or which are only divided by climatal differences or by mountain ranges, are less unlike in their chief forms of life. Thus are constituted zoological regions, which represent the most permanent geographical features of the globe, and afford us an indication of that permanence in the isolation and peculiarity of their animal inhabitants.

Zoological Regions.—Although there is some difference of opinion as to the number and limits of the primary divisions of the earth termed regions, the following are now generally admitted to be the most satisfactory. They are nearly identical with those first proposed by Mr P. L. Sclater in 1857.

1. The Palæarctic Region, which includes all Europe to the Azores and Iceland, all temperate Asia from the high Himalayas and west of the Indus, with Japan, and China from Ningpo and to the north of the watershed of the Yang-tse-kiang; also North Africa and Arabia, to about the line of the tropic of Cancer. This may be popularly called the European region, Europe being the richest and most varied portion of it and containing representatives of all the more important types; but it must not be forgotten that the region includes a much larger area in Asia, and that there are many peculiar North Asiatic animals.
2. The Ethiopian Region, which includes all Africa south of the tropic of Cancer, as well as the southern part of Arabia, with Madagascar and the adjacent islands. It may be popularly termed the African region.
3. The Oriental region, which is comparatively small, including India and Ceylon, the Indo-Chinese countries and southern China, and the Malay Archipelago as far as the Philippines, Borneo, and Java. It may be popularly called the South Asiatic or Indian region.
4. The Australian Region, which is composed of the remainder of the Malay Archipelago, Australia, New Zealand, and all the tropical islands of the Pacific, as far east as the Marquesas and the Low Archipelago.
5. The Neotropical Region, which comprises the whole of South America and the adjacent islands, the West Indies or Antilles, and the tropical parts of Central America and Mexico. It may be well called the South American region.
6. The Nearctic region, which consists of all temperate and arctic North America, with Greenland, and is thus well described as the North American region.

These six regions, although all of primary importance from their extent, and well marked by their total assemblage of animal forms, vary greatly in their zoological richness, their degree of isolation, and their relationship to each other. The Australian region is the most peculiar and the most isolated, but it is comparatively small, and poor in the higher animals. The Neotropical region comes next in peculiarity and isolation, but it is extensive and excessively rich in all forms of life. The Ethiopian and Oriental regions are also very rich, but they have much in common The Palæarctic and Nearctic regions, being wholly temperate, are less rich, and they too have many resemblances to each other; but while the Nearctic region has many groups in common with the Neotropical, the Palæarctic is closely connected with the Oriental and Ethiopian regions. The cause of these various resemblances and differences depends on the past history of the earth, and will be better understood when we have sketched the zoological features of each region and the changes they have undergone in the latest geological periods.

I. *The Palæarctic Region.*—This extensive region, though varied in physical aspect, and often covered with luxuriant vegetation, is poor in animal life when compared with the great tropical regions of the Old and New Worlds. This is no doubt due mainly to climate, but also in part to so much of its surface being densely populated and highly cultivated. It contains, however, a number of characteristic and not a few altogether peculiar animal forms. Beginning with the Mammalia, we have first the sheep and goats with such allied forms as the chamois and saiga-antelope, which are especially characteristic; deer are abundant and varied; the smaller cats, the wolves, the foxes, and the bears abound, with a variety of smaller groups, as weasels, badgers, and some otters. Seals are plentiful on the northern coast, and even in the Black and Caspian Seas; wild horses and asses abound in Asia, as they once did in Europe; there are many peculiar forms of mice, voles, and hamsters; while dormice, squirrels, marmots, hares, and pikas are well-marked features of the region. The insectivorous family of the moles is almost peculiar, as are the curious mole-rats (*Spalax*). The genera which are peculiar to the Palæarctic region belong to the following families:—to the moles (*Talpidæ*) 7 genera; to the dogs (*Canidæ*) 1 genus; to the weasels (*Mustelidæ*) 3 genera; to the pandas (*Æluridæ*) 1 genus; to the seals (*Phocidæ*) 1 genus; to the camels (*Camelidæ*) 1 genus; to the deer (*Cervidæ*) 3 genera; to the hollow-horned ruminants (*Bovidæ*) 7 genera; to the rats (*Muridæ*) 6 genera; to the mole-rats (*Spalacidæ*) 2 genera; to the *Octodontidæ*, a peculiar group of rat-like animals only found in South America, Abyssinia, and North Africa, 1 genus.

In birds, the Palæarctic region is pre-eminently rich in thrushes, warblers, titmice, jays and magpies, sparrows, and buntings. It also abounds in grouse, and in its eastern half in magnificent pheasants. Water-birds are plentiful, and its northern districts produce many fine ducks and divers. The following enumeration of the families of which the Palæarctic region possesses peculiar genera will help to give an idea of the characteristic features of its ornithology:—Of the warblers (*Sylviidæ*) 15 genera, many of which, however, migrate into tropical Africa and India in winter; of babblers (*Timaliidæ*) 1 genus; of reedlings (*Panuridæ*) 4 genera; of creepers (*Certhiidæ*) 1 genus; of tits (*Paridæ*) 1 genus; of the crow family (*Corvidæ*) 4 genera; of finches and buntings (*Fringillidæ*) 12 genera; of starlings (*Sturnidæ*) 1 genus; of larks (*Alaudidæ*) 2 genera; of sand-grouse (*Pteroclidæ*) 1 genus; of grouse (*Tetraonidæ*) 4 genera; of pheasants (*Phasianidæ*) 5 genera; of vultures (*Vulturidæ*) 1 genus; of rails (*Rallidæ*) 1 genus; of snipes (*Scolopacidæ*) 4 genera; of coursers (*Glareolidæ*) 1 genus; of bustards (*Otididæ*) 1 genus.

Of the remaining groups less accurate information is obtainable, and their distribution is less generally interesting. Reptiles, being heat-loving animals, are comparatively scarce, yet in the desert regions they are more plentiful and furnish a considerable number of peculiar types, there

being two genera of snakes and four of lizards not found in any other region. All reptiles diminish rapidly as we go north, and cease before we reach the Arctic circle. The common viper reaches 67° N. lat. in Scandinavia, the northern limit of reptiles in the region. Amphibia are much more patient of cold, the common frog ranging to the extreme north of Europe. There are no less than 16 peculiar genera of Amphibia, 8 of the tailed and 8 of the tailless group, the most remarkable being the *Proteus*, found only in subterranean lakes in Carniola and Carinthia.

Of fresh-water fishes about 20 genera are wholly confined to the region, of which the perches (*Percidæ*) have 3 genera; the salmons and trout (*Salmonidæ*) 3 genera; the carp (*Cyprinidæ*) 13 genera; with a peculiar genus and family (*Comephorus*) found in Lake Baikal, and another (*Tellia*) belonging to the *Cyprinodontidæ*, in the Atlas Mountains.

Insects are so extensive a class that the barest enumeration of their most remarkable forms would be out of place in such a sketch as this. We can only mention that, although butterflies are not very numerous, yet no less than 15 genera are peculiar to the region. Beetles, however, abound, and the most characteristic Palæarctic group is undoubtedly the *Carabidæ*, or predaceous ground-beetles, which are more predominant here than in any other region, and are also of larger average size—a most unusual circumstance in the insects of a temperate as compared with those of tropical regions.

Land shells are tolerably numerous both in species and individuals, but are of small size and little beauty as compared with those of warmer countries. Very few of the genera are peculiar.

The total number of the generic forms of Vertebrata peculiar to the Palæarctic region is, as nearly as can be estimated, 138,—a very large number when we consider the general severity of the winter, and the circumstance that along its whole southern margin this region is bounded by tropical lands with no absolute barrier against intermigration. The amount of peculiarity may be even better estimated by the fact that, out of a total of 274 genera of Mammalia and birds inhabiting the region, 87, or somewhat less than one-third, are confined to it. This mode of estimating the zoological character of a region by *genera*, gives a far truer idea than any enumeration of peculiar *species*, because the former imply more radical and important differences than the latter.

Subdivisions of the Palæarctic Region.—The general zoological characters here given apply with considerable uniformity to the whole of the Palæarctic region, the similarities being of course greater where climate and physical conditions generally correspond. Thus, even between such remote islands as Great Britain and Yesso (North Japan) there is a wonderful similarity in the general forms of life, many of our most familiar birds and insects reappearing at the other extremity of the region under identical or but slightly modified forms. Owing perhaps to the great climatal changes the north temperate zone has undergone in recent geological times, and the vast amount of migration thereby produced, as well as to the absence of any continuous barriers, it is very difficult to mark out with accuracy the zoological subdivisions of this region. Certain broad divisions, depending partly on climate, partly on physical features, and partly on geographical proximity to other regions, may, however, be indicated.

Europe, north of the Pyrenees, Alps, Balkans, and Caucasus, may perhaps be considered as the most typical portion of the Palæarctic region, possessing most of its characteristic features in their full development. It may be termed the European sub-region. South of this comes the Mediterranean sub-region, including South Europe and North Africa, which wonderfully resemble each other in all their chief forms of animal life, although some few purely African species are found south of the Mediterranean. This sub-region includes also Asia Minor and Persia, with Syria and Northern Arabia. It is chiefly characterized by a number of desert forms, such as gazelles, civets, jerboas, quails, desert-larks, and numerous lizards; and by a number of species which cannot endure the colder climate of the north, as porcupines, monkeys, ichneumons, and a host of peculiar groups of insects. To this region belong the Atlantic islands from the Azores to the Canaries, the animal productions of all of them being closely related to those of South Europe or North Africa. It is a curious fact that the remotest of these islands, the Azores, offer less peculiarity in their birds and insects than Madeira and the Canaries, which are so much nearer the continent; but this is sufficiently explained by the greater prevalence of storms and gales in the more northern latitude of the Azores, and helps to prove that aerial currents are the chief means by which these two classes of animals are dispersed. For a discussion of this interesting subject and its bearing on the theories of distribution and development, see Wallace, *Geographical Distribution of Animals*, vol. i. p. 206.

The northern part of Asia differs very little in the main features of its zoology from the corresponding parts of Europe, but as we approach the northern slopes of the great plateau of Central Asia many peculiar forms occur, as wild horse, pikas (*Lagomys*), starlings of the genus *Podoces*, and many others. The great desert plateaus of Thibet and Mongolia form another subdivision, with many peculiar forms. Here are found the yak, some peculiar antelopes, with wild sheep and goats, and several peculiar rodents; and among birds many peculiar forms of grouse, partridges, and pheasants.

Another well-marked division is formed by the temperate portion of Eastern Asia, comprising Japan, Manchuria, Northern and Central China, with parts of East Thibet and the higher portions of the Himalayas as far west as Nepaul. This is a fertile and luxuriant district which receives several tropical forms of life from the adjoining Oriental region. It is rich in Insectivora and in deer, the deer-like musk being confined to it; it has a peculiar form of wild-dog (*Nyctereutes*), and even several peculiar species of the monkey tribe. It is also pre-eminently the home of the pheasant tribe, such magnificent birds as the golden, silver, and Reeve's pheasants being peculiar to it. It has also a number of showy jays, finches, tits, and warblers; and its insects present a number of fine tropical-looking species. The Manchurian sub-region has thus a very beautiful and varied fauna, but the intermingling of Oriental types, and the uncertainty of its southern boundary, render it less characteristically Palæarctic than the European sub-regions.

II. *The Ethiopian Region.*—This region is much less extensive than the last, but being almost wholly tropical it presents a richer and more varied assemblage of animals. Its southern extremity, although really extra-tropical, is yet so warm and so little subject to extremes of temperature that the growth of vegetation and the corresponding development of animal life are scarcely diminished, and the same may be said of the elevated interior of the continent. As Madagascar is quite isolated and its productions very peculiar, it will be best first to sketch the main features of African zoology, which are tolerably well marked and homogeneous.

The African continent is pre-eminently the country of large Mammalia. It possesses an abundance of elephants, rhinoceroses of several species, giraffes (now peculiar to it), gorillas and baboons—the largest of the ape tribe, a host of large and remarkable antelopes, the huge hippopotamus, several species of zebras, wild buffaloes, several remarkable forms of swine, and an abundance of lions, leopards, and hyænas,—forming together an assemblage of large and highly organized animals such as occur nowhere else upon the globe. There are also many smaller, but very remarkable forms. There are 7 peculiar genera of apes, 3 of lemurs, 5 of *Insectivora*, 12 of *Viverridæ*, the remarkable *Proteles* forming a distinct family allied to hyænas and weasels, 2 of *Canidæ*, 2 of *Mustelidæ*, 2 of *Suidæ*, 1 of *Tragulidæ*, 12 of *Bovidæ* (antelopes), 18 of various families of Rodents, and the curious aardvark (*Orycteropus*), forming a distinct family of *Edentata*.

In birds Africa is not so peculiar, yet it has many remarkable groups. Such are the plantain-eaters (*Musophagidæ*), the colies (*Coliidæ*), the secretary-birds (*Serpentariidæ*), the ground horn-bills, and the guinea-fowl,—all of which are peculiar. It abounds also in peculiar fly-catchers, shrikes, sun-birds, weaver-birds, starlings, larks, barbets, grouse, and hawks,—more than half the genera of land-birds being peculiar, and, if we include those of Madagascar, nearly two-thirds.

Reptiles abound, there being three peculiar families of snakes and one of lizards; and there is one peculiar family of toads. There are also three peculiar families of fresh-water fishes.

It is impossible to give any idea of the special features presented by the insects and land-shells without going into details which would be out of place in such a sketch as we are here giving. In both these groups Africa is fully as rich as the other tropical regions, and exhibits perhaps more peculiar features than among the higher animals.

We must, however, just mention the remarkable absence from the Ethiopian region of certain groups of Mammalia which abound in the countries to the north and east of it, as this phenomenon has an important bearing on the probable origin of the fauna. The most striking of these deficiencies are the two families of the deer and the bears, which abound over the whole northern hemisphere, in tropical Asia and the Malay islands, and even in North Africa, but are both entirely unknown over the whole Ethiopian region, as are, among smaller groups, the goats and sheep, the true oxen, and the mole family. Among birds such wide-spread groups as the wrens (*Troglodytidæ*), dippers (*Cinclidæ*), and the true pheasants are also entirely wanting.

The exceeding speciality of the forms of life which are still found in the Ethiopian region is well shown by the fact that there are about 24 family groups of vertebrate animals which are entirely confined to it, while two-thirds of its genera of Mammalia, and three-fifths of the genera of birds, are also peculiar.

Subdivisions of the Ethiopian Region.—The most remarkable of these is undoubtedly that comprising Madagascar and the Mascarene islands, a district which contains so many singular forms of life that it has been proposed by some naturalists to make it one of the primary zoological regions. The peculiarity of these islands is twofold, consisting as much in the absence of a great number of the most characteristic African forms as in the possession of others entirely peculiar. The apes and monkeys, the large Carnivora, the zebras, giraffes, antelopes, elephants, and rhinoceroses, and even such smaller forms as the porcupines and squirrels, are entirely wanting. Yet Madagascar possesses a host of remarkable *Lemuridæ*, consisting of 7 genera and 35 species, all of which are peculiar; a peculiar family of *Insectivora*, comprising 5 genera and 10 species; a peculiar family and 5 peculiar genera of small *Carnivora*; and 3 peculiar genera of *Muridæ*. Even among birds, so much better able to traverse a narrow sea, there are some curious deficiencies, the families of woodpeckers (*Picidæ*), honey-guides (*Indicatoridæ*), barbets (*Megalæmidæ*), plantain-eaters (*Musophagidæ*), colies (*Coliidæ*), hornbills (*Bucerotidæ*), and mockers (*Irrisoridæ*)—all abundant on the opposite coast of Africa—being entirely wanting. Yet birds are sufficiently abundant, nearly 120 species of true land-birds being known, while there are no less than 33 genera which are altogether confined to Madagascar and the Mascarene islands. If we consider the species, the peculiarity is even more remarkable, there being more than a hundred which are peculiar to about a dozen which are found elsewhere. These numbers, however, by no means fairly represent the special character of the Mascarene bird-fauna, which consists in the anomalous characters of many of the genera, so that it is to this day a matter of dispute among ornithologists in what families a considerable number of them should be classed. Among these anomalous genera are *Mesites*, *Tylas*, *Artamia*, *Calicalicus*, *Eurycerus*, *Philepitta*, *Leptosomus*, *Ateleraix*, and several others. Taking all these facts into consideration, we arrive at the conclusion that the fauna of Madagascar is more peculiar than that of any other single island on the globe.

The reptiles of Madagascar are less known, but they exhibit some remarkable peculiarities. Many African groups are wanting, others are represented by peculiar genera, while a considerable number of groups have their nearest allies, not in Africa, but in tropical Asia and in South America. Among insects the butterflies are allied to those of Africa; but the beetles, like the reptiles, show many cases of affinity with the Malay islands and South America, though the majority are perhaps related to true Ethiopian forms.

The continental part of the Ethiopian region appears to have no subdivisions clearly marked out by natural barriers, yet it may be divided into three tolerably well-defined sub-regions in accordance with differences of climate and vegetation. These may be termed the sub-region of open plains, the forest sub-region, and the south temperate sub-region.

The first comprises the greater part of Central and East Africa, and a northern belt from Senegambia through Lake Chad to Abyssinia, while it extends to the Atlantic coast from Angola to Damara Land. This extensive district may doubtless be further subdivided, but it exhibits throughout the main features of Central African zoology as distinct from that of West and South Africa. Its zoological characters are negative rather than positive, as it has very few peculiar groups; but all the great African Mammalia abound, and a greater variety of antelopes are found here than in the other sub-regions.

The West African or forest sub-region extends from the Gambia to the Congo, and inland to the sources of the Nile and the western watershed of the great lakes. It is characterized generally by a luxuriant forest-vegetation, and it possesses many peculiar animal forms. Here we find the gorilla and chimpanzee, a great variety of monkeys, and two peculiar genera of lemurs, as well as some remarkable genera of *Insectivora*, *Viverridæ*, and *Tragulidæ*. It is the home of the gray parrots (*Psittacus*), the typical plaintain-eaters (*Musophaga*), one of the Eastern group of ground-thrushes (*Pitta*), and many peculiar genera of passerine birds. Reptiles are very abundant, no less than 13 genera of snakes and 3 of lizards being peculiar to this sub-region. As is always the case in tropical forest-districts, insects are especially numerous, of large size and brilliant colours.

The South African or extra-tropical sub-region, though quite open to the central districts and to a large extent overrun with the same fauna, yet presents so many peculiarities as to indicate, probably, a former southward extension of the continent. We find here 3 peculiar genera of *Viverridæ*, the remarkable *Proteles*, peculiar *Canidæ* and *Mustelidæ*, many peculiar rodents, including *Bathyergus* (one of the mole-rats), *Petromys* (one of the spiny-rats), and *Pedetes* (the Cape-hare). There are also some peculiar genera of birds, among which are a sun-bird, 2 weaver-birds, 3 larks, and a curious woodpecker (*Geocolaptes*). Reptiles are still more peculiar, 4 genera of snakes and 10 of lizards being almost or quite restricted to this limited district. Insects, too, are very remarkable, there being 7 peculiar genera of butterflies, and a host of beetles which are either quite peculiar or have their nearest allies in Madagascar, in India, or America. This remarkable and isolated fauna must be considered, in connection with the wonderful Cape flora—so much richer and more isolated than that of any other part of Africa—as indicating important changes in the past history of this part of the globe.

III. *The Oriental Region.*—The Oriental region is wholly tropical, but is of smaller extent than the Ethiopian. It is very largely covered with forest-vegetation, and is much broken up into islands and promontories, conditions so favourable to animal life as fully to compensate for its smaller area.

In the larger Mammalia there are many resemblances between the Oriental and Ethiopian regions. Both have anthropoid apes, elephants, rhinoceroses, large felines, buffaloes, and an abundance of civets. But the Oriental region abounds in deer and bears, it has many remarkable Insectivora, the Malay tapir, and many wild cattle. It has also a great number of characteristic forms of life. It has 6 peculiar genera of apes, and 3 of lemurs; 5 of Insectivora, among which are two peculiar families, *Galeopithecidæ* and *Tupaiidæ*; 12 of *Viverridæ*; 1 one of *Canidæ*; 5 of *Mustelidæ*; 2 of *Ursidæ*; 1 of *Tragulidæ*; 1 of *Cervidæ*; 4 of *Bovidæ*; and 5 of Rodents.

The birds of this region are exceedingly abundant, varied, and remarkable. Among them are 3 peculiar families of passerine birds—the hill-tits (*Liotrichidæ*), the green bulbuls (*Phyllornithidæ*), and the gapers (*Eurylæmidæ*); while the babblers (*Timaliidæ*), the fruit-thrushes (*Pycnonotidæ*), and the king-crows (*Dicruridæ*) are far more abundant than in the adjacent regions. Tits, flycatchers, crows, sun-birds, starlings, kingfishers, pigeons, and pheasants are also very abundant, and are represented by many remarkable forms. More than 340 genera of land-birds inhabit the region, of which number 165 are peculiar to it. Reptiles are very abundant. Three small families of snakes are peculiar, and there are a large number of peculiar genera both of snakes and lizards.

Insects are exceedingly varied and beautiful, especially in the Himalayas and in the Malay islands. Among butterflies the *Danaidæ* are very abundant, while the true *Papilios* are perhaps finer than in any other part of the

world. Among beetles the *Lucanidæ*, *Cetoniidæ*, and *Buprestidæ* are especially remarkable, while the elegant Longicorns have their full quota of curious and beautiful forms.

Subdivisions of the Oriental Region.—These are tolerably well marked, though very unequal in extent and productiveness. The Himalayan slopes with all the Indo-Chinese countries form the chief and most typical part of the region. Here are the greatest variety of Mammalia and birds, and almost all the more important groups are represented. Three genera of Mammalia and 44 of birds are peculiar to this sub-region.

The Malay Peninsula, with the larger Malay islands, as far as Java, Borneo, and the Philippines, form a sub-region which has much in common with the last, and is almost equally rich, and in some groups even richer and more peculiar. Thus it has no less than 14 genera of Mammalia and more than 40 genera of birds which are wholly peculiar to it, among which are such interesting forms as the orang-utans (*Simia*), the spectre-lemur (*Tarsius*), the flying-lemur (*Galeopithecus*), the feather-tailed tupaia (*Ptilocerus*), the sun-bear (*Helarctos*), and the magnificent argus-pheasants (*Argusianus*). About an equal number of genera are common to the Malayan and the Indo-Chinese sub-regions, but are not found elsewhere; so that the two have much in common, and together comprise nearly all that is most remarkable and beautiful of the Oriental fauna.

The other two sub-regions consist of the peninsula of India and Ceylon, whose chief feature is their comparative zoological poverty. Taking first what may be termed the Indian sub-region, extending from the foot of the Himalayas to the Carnatic, we find that this extensive and fertile region, though abounding in life of every kind, yet possesses no peculiar genus of either Mammalia or birds; while, favoured by the open and arid plains of which much of the surface consists, some African types are more abundant than in other parts of the region, though these are numerically unimportant.

Ceylon and Southern India are somewhat more interesting, as they possess some peculiar forms, and others in common with the Malay islands. Among the former is *Loris*, a peculiar lemur; and there is a peculiar genus of *Muridæ*, as well as one or two peculiar genera of birds. There are also several peculiar species of monkeys, and the Malayan genus *Tupaia;* while among birds we find Malayan forms of cuckoos and *Timaliidæ*. The reptiles, however, best characterize this sub-region, as it possesses an entirely peculiar family of snakes (*Uropeltidæ*), consisting of 5 genera and 18 species, as well as 4 other peculiar genera of snakes. There are also many peculiar genera of lizards belonging to the *Agamidæ* and *Acontiadæ*, and 3 peculiar genera of tailless Batrachia. The insects also offer some remarkable cases of Malayan affinity, the genus *Hestia* (or spectre-butterflies) being found in Ceylon only beyond the Malay islands; while 6 genera of Malayan Longicorns and the wingless *Tricondyla* belonging to the *Cicindelidæ*, are in the same category. The combination of so many peculiarities justifies the separation of Ceylon and a portion of Southern India as a distinct Oriental sub-region.

IV. *The Australian Region.*—On entering this region we meet with such a radical change in all the higher forms of life, that the zoologist seems to have got into a new world. Even the Austro-Malay islands, though differing in no way in climate or luxuriance of vegetation from the Indo-Malay islands to the west of them, exhibit this change in an almost equally marked degree. With the exception of Celebes, which is a debatable land hardly belonging to either region, the other islands only posssess a few deer and pigs to represent the host of varied Mammalia—from the elephant and tapir to the squirrel and monkey—which characterize every part of the Oriental region to its extreme south-eastern limits in Java and Borneo. In place of these we have Marsupials only, in great variety in the extensive country of Australia and less abundantly in the islands; and besides these, only those flying mammals—the bats, which can traverse the ocean, and the smallest forms of rodents, the mice—which may be occasionally carried by floating trees or other accidental means across narrow arms of the sea. There are 5 distinct families and 33 genera of Australian Marsupials, as well as 2 families and genera of the still more lowly-organized Monotremata which comprise the anomalous *Ornithorhynchus* and *Echidna*.

Birds, as might be expected, are not so excessively peculiar, a large number of almost cosmopolitan families extending into Australia; yet there are no less than 16 families altogether characteristic of the region, among which are such remarkable forms as the Paradise-birds (*Paradisæidæ*), the honey-suckers (*Meliphagidæ*), the lyre-birds (*Menuridæ*), the cockatoos (*Cacatuidæ*), the lories (*Trichoglossidæ*), the mound-builders (*Megapodiidæ*), and the cassowaries (*Casuariidæ*). Among the important groups which are entirely wanting in Australia are the barbets (*Megalæmidæ*), the woodpeckers (*Picidæ*, otherwise cosmopolitan), the trogons (*Trogonidæ*), and the pheasants (*Phasianidæ*). The reptiles, as in most other cases, offer less marked peculiarities than the birds; but a large proportion of the genera are peculiar, and there are even 3 peculiar families of lizards, as well as the singular *Hatteria* of New Zealand, which constitutes not only a separate family but a new order of reptiles. The Amphibia and fresh-water fishes present a corresponding amount of peculiarity; and the recent discovery of the genus *Ceratodus* (the mud-fish) is very interesting, since its nearest allies appear to have lived early in the Secondary period, while other members of the same group are found isolated in the rivers of tropical Africa and America.

Insects are very abundant in Australia and the Austro-Malay islands; but owing to the various means by which these small creatures are conveyed across the seas, and the identity of physical conditions in the Oriental and Australian portions of the archipelago, the true Australian fauna is chiefly developed in Australia itself, where there are a considerable number of peculiar genera in all orders of insects.

Subdivisions of the Australian Region.—Besides the Australian continent, which is by far the richest and most important part of the region, there are three groups of islands which have each some distinctive peculiarities. These are the Austro-Malay islands, comprising New Guinea, the Moluccas, and the Timor group; the Pacific islands, and the New Zealand group. The first is very rich, especially in birds and insects while the other two are exceedingly poor.

The Austro-Malayan sub-region, of which New Guinea is the central mass, is comparatively poor in Mammalia, only 9 genera of marsupials being yet known, 6 of them being peculiar, with pigs, a few mice, and some deer (perhaps introduced) in the Moluccas. Birds are far more numerous, the Paradise birds and the true crimson lories being peculiar to the sub-region, while more than 40 genera of land-birds are confined to it. It is exceptionally rich in peculiar forms of flycatchers, honey-suckers, kingfishers, cockatoos, and pigeons; and its birds are generally characterized by a brilliancy of plumage far exceeding that which prevails in the surrounding regions. The insects exhibit a similar brilliancy, some of the finest butterflies and beetles in the world belonging to this sub-region.

Directly we pass east of the Solomon Islands we enter upon one of the poorest zoological regions in the world in proportion to its extent and luxuriant vegetation, the only exception to this poverty being in the land-shells, which are very largely developed and very peculiar. Indigenous Mammalia are wholly wanting. Birds are very scarce, no more than about 150 species being known from the numerous islands scattered over 5000 miles of the Pacific, while there are only about a dozen peculiar genera. Reptiles are more numerous than might be expected, considering the wide extent of ocean separating many of the islands. There are 14 genera of lizards, of which 6 are peculiar, but few extend eastward of the Samoa Islands. Snakes are much less abundant, and none are found east of the Fiji Islands. Insects are exceedingly scarce, and of little interest.

The New Zealand group, though situated beyond the tropics and very remote from other lands, yet possesses a more ample and more interesting fauna. If we except two bats, mammals are wanting; but birds are tolerably abundant, and are very peculiar and interesting. There are 34 genera of land-birds, of which 16 are peculiar. Twelve of these are passerine birds, chiefly *Meliphagidæ* and *Sturnidæ*, with *Nestor* and *Stringops*, peculiar genera of parrots, and the extraordinary wingless *Apteryx*. Reptiles are few. There are a few lizards, with one peculiar genus, but no snakes. The anomalous *Hatteria* has been already mentioned. There is also one frog belonging to a peculiar genus. There are some interesting fresh-water fishes, one genus belonging to the *Salmonidæ*, a family not occurring elsewhere in the southern hemisphere; and there are several species allied to South American fishes.

Insects are very few, and generally of small size and inconspicuous colours. Many of them are peculiar, but they have mostly affinities with Australian groups, or with those from the Oriental region.

V. *The Neotropical Region.*—This is in some respects the richest zoological region on the globe, yet it has certain resemblances to the Australian region, which is the poorest, and which it follows in natural order. This is owing to both being inhabited mainly by low types of Mammalia and birds, some of which have been preserved from early geological times, the Marsupials being a good example. But there has also been some intermigration between south temperate America and Australia, by means of intermediate islands and floating ice, and this has led to a community of forms in a few groups to which such a mode of transmission was possible.

The Mammalia are as abundant and varied as in any other countries except Africa and tropical Asia; but the region is characterized by poverty in the more highly organized forms, with a corresponding abundance of lower types. Monkeys are abundant, but all belong to two peculiar families—*Cebidæ* and *Hapalidæ*—different in structure and of a somewhat lower organization than those of the Old World. About half of them have powerfully prehensile tails, a character unknown among the monkeys of the eastern hemisphere. Bats are very numerous, and one extensive family—the *Phyllostomidæ*, or vampyre-bats—is peculiar. Insectivora are unknown in South America, but one peculiar genus occurs in the larger Antilles, and a few shrews in Central America. The Carnivora are but moderately numerous, the *Civet* family being entirely wanting, as are the bears, with the exception of a solitary species in Chili. There is, however, one peculiar family—the *Procyonidæ*—which extends over North America as well. A marked feature is the excessive scarcity of the great family of the Ungulata, or hoofed animals. There are no wild cattle, sheep, goats, antelopes, horses, or rhinoceroses; and only a very few species of tapirs, peccaries, llamas, and deer in their place. Coming to the small and feeble Rodents, however, we find a great abundance and variety of forms, including the largest on the globe. Five families are peculiar or nearly so,—the chinchillas and the cavies being the most important, while all the genera, except *Sciurus* and *Lepus*, are peculiar to the American continent. We now come to the Edentata, the most imperfectly organized and the most characteristic of the Neotropical mammals. There are twelve genera belonging to the three families of the sloths (*Bradypodidæ*), the armadillos (*Dasypodidæ*), and the ant-eaters (*Myrmecophagidæ*). Lastly, we have the Marsupial opossums, which range far over temperate North America, but are most abundant in the tropical regions of South America.

In birds the Neotropical region is wonderfully rich. It possesses far more distinct genera and species than any other region, and it has 24 entire families peculiar to it, while the region which comes next in speciality and isolation as regards this order—the Australian—has only 16. Most of these peculiar families are, however, of a somewhat low grade of organization, and it is these which abound most in genera and species and give a special feature to the ornithology of the country. These peculiarly American families (for some of them range into North America) are the tyrant fly-catchers (*Tyrannidæ*), the manakins (*Pipridæ*), the chatterers (*Cotingidæ*), the plant-cutters (*Phytotomidæ*), the tree-creepers (*Dendrocolaptidæ*), the ant-thrushes (*Formicariidæ*), and the wren-thrushes (*Pteroptochidæ*). All these have a deficiency in the singing-muscles of the throat, and they comprise more than 200 genera. Then, among the *Picariæ*, which are a low though wide-spread order, we have the toucans (*Rhamphastidæ*), the puff-birds (*Bucconidæ*), the jacamars (*Galbulidæ*), the motmots (*Momotidæ*), and the humming-birds (*Trochilidæ*), comprising 140 genera. The only peculiar families of high organization are the sugar-birds (*Cœrebidæ*), the greenlets (*Vireonidæ*), the hang-nests (*Icteridæ*), and the tanagers (*Tanagridæ*), comprising in all 82 genera. The most highly organized groups of birds, and those which are most abundant in the eastern hemisphere, such as crows, starlings, thrushes, warblers, and flycathers, are either scarce or entirely wanting. Finches are numerous, as are parrots. Among game-birds the higher types, as the grouse (*Tetraonidæ*), are scarce; while the more lowly-organized curassows (*Cracidæ*) and tinamous (*Tinamidæ*) are much more abundant and more widely distributed over the whole region. Among the wading groups (*Grallæ*), which are decidedly of low organization, there are 6 peculiar and very isolated families, the most remarkable being the *Cariamidæ*, the *Psophiidæ* (trumpeters), the *Eurypygidæ* (sun-bitterns), and the *Palamedeidæ* (horned-screamers). The very low struthious type is represented by the American ostriches (*Rhea*).

Reptiles are also very abundant in the Neotropical region, and there are many peculiar groups. Snakes are represented by peculiar genera only, the families being almost always widely and often universally distributed in warm regions; lizards are more restricted in their range, and no less than 5 families are peculiar to the region, while 9 are found only in the American continent. All are of very small extent except two, the *Teidæ* and *Iguanidæ*, which are very numerous, and comprise the most characteristic American lizards. There are also 4 peculiar families of tailless Batrachians, the most popularly known being the *Pipidæ*, which contains the remarkable Surinam toad.

Fresh-water fishes are probably more abundant and varied than in any other region. Three entire families and several sub-family groups are peculiar, and the enormous forest-bordered rivers and extensive tracts of annually flooded woodland have led to the development of special groups of fruit-eating fishes, which, as articles of food, are not only unsurpassed but altogether unequalled in any other part of the globe. Fresh-water rays (*Trygonidæ*) and electric eels (*Gymnotidæ*) are also peculiar to Neotropical rivers, and there are an immense variety of *Siluridæ*, *Characinidæ*, and *Cyprinodontidæ*. It is reported that Professor Agassiz obtained more than a thousand species of fishes in the Amazon alone; but, although this may be exaggeration, there is no doubt that a still greater number exists in that wonderful river and its tributaries.

The insects of tropical America are so inexhaustible in their variety, and so wonderful in their beauty, that it is hopeless to attempt to give an adequate idea of them. The butterflies are far more abundant and more gorgeous than in any other region, and their variety may be imagined from the fact that the peculiar genera are nearly equal in number to those of the rest of the world. The beetles, though very abundant, are not so clearly preponderant over those of all other regions. The stag-beetles (*Lucanidæ*) and rose-chafers (*Cetoniidæ*) are somewhat poorly developed; but all the other large families are very abundant, and comprise many forms of extreme beauty and interest. Such are the genera *Agra* among Carabidæ, *Pyrodes* among Longicorns, and *Entimus* among Curculionidæ. Land-shells equally surpass those of all other regions, but this is owing to the exceptional richness of the West Indian islands, the continent of America being by no means extraordinarily rich in this class of animals.

Subdivisions of the Neotropical Region.—The manner in which this region may be most naturally and conveniently divided for zoological purposes is doubtful. Almost the whole of tropical South America (excluding only the higher Andes south of Chimborazo and the dry plain to the west) forms a compact area in which all the more characteristic Neotropical animal groups are developed in their highest luxuriance. This, however, falls natu