lating animal matter, as stated by many observers in this and other countries. He says that so far as *Pinguicula longifolia* and *Drosera rotundifolia* are concerned, at least, he believes that the glutinous excretions of their leaves simply hasten decomposition, which is moreover attended by the usual concomitant phenomena. In very early stages he found monads, bacteria, the mycelium of various fungi, and other conditions of putrefaction. So far as the action of the mucus on the entrapped insects and on coagulated albumen is concerned, he affirms that it is similar to that of pure water, sugar-water, and the honey-secretions taken from the flowers of *Aechmea nudiflora*. Nevertheless he admits having seen all the admirable contrivances for catching and retaining insects.

MR. G. M. DAWSON, F.G.S., has just issued a report to the Canadian Government, on the geology and resources of the region in the forty-ninth parallel, between the Lake of the Woods, S.E. of Lake Winnipeg, and the Rocky Mountains; in other words, of the western portion of the boundary of British America. Much of the country traversed had been previously quite unknown, geographically as well as geologically, which fact adds greatly to the importance of the report, the bulk of which is devoted to the account of the Cretaceous and Tertiary strata of the plains between the Rocky Mountains, as they are constituted at the boundary, and the Lake of the Woods. The Survey of the United States Government to the south of the above-mentioned region, when taken in conjunction with that under notice, forms a vast addition to geologic knowledge. Among the most important results arrived at is the discovery of beds which seem to gap over the apparently considerable interval between the Cretaceous and lower Tertiary periods.

THE following interesting statistics on the libraries of Europe are taken from M. Block's recently published "Statistique de la France comparée avec les divers pays de l'Europe":—Paris has six great libraries belonging to the State and open to the public. Outside Paris there are in France 338 libraries which possess more than 3½ million volumes; of this number 41 are open in the evening. Great Britain possesses 1,771,493 volumes, or six vols. to each 100 persons of the population (this must surely refer solely to the British Museum library). Italy has 11·7 volumes per 100 inhabitants. In France there are 4,389,000 volumes, or 11·7 per 100 persons; in Austria, 2,488,000 vols. or 6·9 per 100; in Russia, 852,000 vols., or 1·3 per 100; in Belgium, 509,100 vols., or 10·4 per 100. Of all countries, France possesses the greatest number of volumes, and Paris alone has one-third of them in its libraries. Since 1865 students' libraries have been formed over nearly the whole of France. Since that year these libraries have increased from 4,833, containing 180,854 volumes, to (in 1870–1) 13,638, containing 1,158,742 volumes.

THE additions to the Zoological Society's Gardens during the past week include four Tigers (*Felis tigris*) from India, presented by H.E. the Governor-General of India; an Ocelot (*Felis pardalis*) from South America, presented by Mr. H. Kirtley; a Golden Agouti (*Dasyprocta aguti*) from South America, presented by Mr. Henry T. Balfour; a Cuvier's Toucan (*Ramphastos cuvieri*) from Upper Amazons, presented by Mr. A. Blumenthal; a Chilian Sea Eagle (*Geranoaëtus aguia*) from Paraguay, presented by Mr. E. Nelson; two Red and Yellow Macaws (*Ara chloroptera*) from South America, presented by the Misses Rix; three Tigers (*Felis tigris*), a Leopard (*Felis pardus*), a Caracal (*Felis caracal*), two Musanga Paradoxures (*Paradoxurus musanga*) from India, a Black Lemur (*Lemur macaco*) from Madagascar, a Crab-eating Opossum (*Didelphys cancrivora*) from Central America, two Mexican Deer (*Cervus mexicanus*), deposited; a Great-billed Parrakeet (*Tanygnathus megalorhynchus*) from Gilolo, received in exchange; an American Darter (*Plotus anhinga*) from South America, purchased.

SOME LECTURE NOTES ON METEORITES*

II.

WE may next turn our attention to the nature of the substances which fall on these occasions, and in the first place it may be briefly stated that they are of three kinds: first, masses of iron, alloyed with nickel, termed aërosiderites, or briefly siderites; secondly, stony meteorites (aërolites), which consist of silicates somewhat analogous to terrestrial rocks, but having nickeliferous iron disseminated in small granules throughout them: and finally, there is a sort of meteorite which is intermediate between these iron and stone masses, consisting of a sponge-like mass of the iron, containing in its hollows stony matter similar to that of the aërolites. These are what are termed siderolites (or meso-siderites). These different kinds of meteorites—namely, siderites, siderolites, and aërolites—then, comprehend all the forms of matter, as at present known, which fall to the earth from the regions external to its atmosphere.

Of these different kinds of meteorites, national as well as private collections have been formed in most countries in Europe. The most celebrated and historical collection of them is that at Vienna, formed by the gradual and generally contemporary acquisition of specimens of the meteorites as they have fallen or been found from time to time, from the early years of this century, and descriptions of them have been given by very eminent Viennese mineralogists. Then we have in the British Museum a not less complete collection, numbering now about 294 different meteorites. Next to these in completeness is the collection at Berlin, founded on that formed by Chladni.

The importance of the study of such collections of meteorites becomes evident, if we consider a remark of Humboldt's, in the latter part of his "Cosmos," to the effect that there are only two avenues to our knowledge of the universe outside of us, one being light, by the agency of which the motions of the heavenly bodies are revealed to us, while the other consists in the masses of matter that come to our earth from that outer universe; and that these are the only means by which we are able to take any cognisance of what is going on in the boundless regions of space.

Since Humboldt's time, indeed, light has become a totally different instrument in our hands to what it was. No longer are the heavens for us without speech or language, for light is indeed the language of the universe, though man has only yesterday begun to interpret the voices whereby one star calleth to another star.

Our interpreter is the prism, that most subtle and sensitive implement for probing the character of the most distant matter provided only it be luminous. In Humboldt's time light merely enabled us to record and calculate the mute motions of the orbs around us. Now not only are we able so to tell their motions, but we may feel new truths "trembling along that far-reaching line" which connects our eye with a star, and take cognisance of the physical conditions and chemical composition of the matter in active change upon the surface of that star. And this altogether new source of knowledge throws an entirely new interest around the question of the origin or sources of meteoric matter. Let us then next inquire of the meteorites themselves what they have to tell us in elucidation of these questions.

The first aspect of a meteorite is that of a fragment. One cannot look at it without saying so. But as to the question whether it came as a fragment into our atmosphere, or whether it became a fragment after it had entered it, we can at least say that its present fragmentary form is mainly due to the action of that atmosphere itself. Still, it is eminently probable, from other grounds, that meteorites encounter our earth, and probably our system, in the guise of fragments, or rather of angular and unshaped masses—chips, as it were, thrown off in the great workshop; matter flung out into space, not yet used up in the making of the worlds. It will be well first to consider what an examination of their physical characters and general internal structure will reveal to us. For the incrustation and pitted surface of aërolites already described an explanation was sought on the hypothesis of external fusion arising from the sudden development of enormous heat on the surface of a mass internally brittle and contracted, owing to its very low temperature. And among the more purely mechanical characteristics, we must not pass over the general want of compactness in meteorites. Thus, though a meteorite generally seems very compact, if it be suspended in chloride of mercury to dissolve the iron without affecting, or with only slight effect on, the other minerals in it, you

* Continued from p. 487.

will dissolve meteoric iron out of it; but the remainder of the mass will, after this treatment, in most cases, crumble into a granular powder, showing that the cohesion of the mass is not like that of an ordinary terrestrial rock. Some aërolites, again, will even crumble in the fingers without previous treatment.

The rocks to which they bear the nearest resemblance, in respect of their mechanical structure, among the products of our volcanoes, are some volcanic bombs, and, as regards several of the aërolites, certain kinds of volcanic tufa.

Now, in examining these bodies more closely, the first thing that calls for attention is that they are composed entirely, or almost entirely, of crystalline substances; and that matter thus coming from regions beyond our world crystallises in the same way, and is obedient to the same law, as matter which crystallises on the globe.

Sections of meteorites cut thin and ground down to transparent slices, when examined by means of polarised light, are seen to be crystallised throughout; the crystalline character of the substances being evidenced by the interference tints which colour the different crystals of which the sections are made up. Another characteristic of many meteorites, in which they differ from ordinary terrestrial rocks, is what has been termed by Gustav Rose their chondritic structure. The minerals in these are found to be more or less aggregated in little spherules, which are distributed in different degrees of abundance in different meteorites through the ground-mass of the stone.

Sections of chondritic meteorites show them to consist in some cases almost entirely of spherules. Such is the case with the Parnallee aërolite, of which the most varied groups of spherules may be seen assembled in a single section. Some of these spherules are encased, as it were, in minute shells of metallic (nickeliferous) iron, or of such iron mingled with a kind of pyrites peculiar to meteorites, an iron sulphide termed troilite, constituted by an equivalent of sulphur combined with one equivalent of iron. Minute granules of troilite and iron, without any definite form, are so seen to be disseminated among the grains of the interspherular ground-mass of the meteorite.

A closer inspection of the spherules further reveals in many cases the presence of *intro*spherular iron. In some spherules the meteoric silicates may be seen, radiating from a point, but while the spherule is enclosed in a mixed outer mass of silicates, iron and troilite in little black specks are seen scattered all through it, presenting the appearance of having been spurted, as it were, from a point, the larger particles to the greater distance: and these specks consist in part of nickeliferous iron, while some are meteoric pyrites (troilite).

In connection with the subject of these spherules, which form so characteristic a feature of many stony meteorites, it should be mentioned that occasionally some of the spherules are seen to be broken in half and the halves separated from each other to some small distance, a fact of considerable significance, though not easy of interpretation in connection with the history of the meteorite and the more or less violent crises it must have passed through at successive periods in that history.

Evidence of another kind of historical succession in the events and influences through which a meteorite may have passed is afforded by the not rare peculiarity of a sort of vein, like a mineral vein, running through the meteorite. In fact, just as in a mine one may meet with a fissure that, once dividing the "country," but subsequently filled by rocky matter, cuts across the course of a mineral vein which itself was originally formed in a similar way; and just as such a cross fissure thus intersecting with the original metalliferous vein often gives us evidence of a *heave*, i.e. that one side of the new fissure has slid upwards or downwards along the other, so an exactly similar thing is met with in meteorites, and is admirably seen in the microscopic sections of them.

Such a fissure will sometimes divide several spherules lying on its track, the two sides of the fissure having slid, the one along the other. The corresponding halves of the spherules are in such cases separated to some distance along the fissure, and this is itself filled with the vein of meteoric iron or troilite, in some cases with a black fused substance, like the crust of a meteorite.

In passing next to the consideration of the chemistry of meteorites, one of the first inquiries that suggests itself is whether and to what extent the elementary composition of these cosmical rock-fragments accords with that of our own world, or with the revelations which the prism has afforded us regarding the constitution of the matter in energetic action on the surface of our sun, or of those far distant suns, the stars; or, again, in those still uninterpreted assemblages of luminous matter that we call the nebulæ. Now, the elements that have been already recognised by analysis as existing in meteorites form a list that comprises one-third of all the elements known to our chemistry; and these, the more abundant elements on our world. They are—

Hydrogen	*Chromium*	Arsenic
Lithium	*Manganese*	Vanadium ?
Sodium	*Iron*	Phosphorus
Potassium	*Nickel*	Sulphur
Magnesium	*Cobalt*	Oxygen
Calcium	*Copper*	Silicon
Aluminium	Tin	Carbon
Titanium	Antimony	Chlorine

Now, of these elements, those in italics have also been found by the spectroscope to be constituents of the solar surface, together with zinc, strontium, and cadmium, which metals have not yet been met with in meteorites.

The number of elements recognised as existing in activity on the solar orb will undoubtedly be largely increased with the progress of the combined study of the solar spectrum and of the conditions under which the several lines belonging to the different elements are developed. It is by study of this kind that Mr. Lockyer has detected potassium in the sun. The fact that at the present time all the elements detected in the sun excepting three are met with in meteorites, while on the other hand the meteorites contain five metals not as yet found in the sun, at the same time that the six metalloids found in them are so strangely all apparently absent from the surface of our great luminary, might seem to place difficulties in the way of our recognising a general unity of elementary composition in the matter that composes the various orbs and wandering masses that pervade our universe.

But it is clear, on the other hand, that it is too early as yet to look on these results as establishing even probable exceptions to such a unity.

That carbon, sulphur, potassium, and phosphorus, elements so frequently met with in meteorites and on our globe, should, with nitrogen, be absent or have escaped detection among the elements involved in the active operations on the surface of the sun, is certainly not a little surprising. Nor is the failure of the prism to detect the lines due to oxygen and silicon among those presented by the solar photosphere to be accounted for by assuming the persistency of particular silicates in resisting decomposition or vaporisation even in a solar temperature, for Von Rath has shown that silicates such as augite and leucite are actually deposited by a process of sublimation even at the comparatively low temperatures of our volcanoes. Yet it is difficult to believe that the last-mentioned elements can be absent from the great central body of our system, whether we reason from analogy, from their great importance in the composition of our earth, or from the more than probability that these elements must have been contributed to a large amount to the material of the sun by meteoric matter falling into his surface.

Mr. Lockyer has indeed grasped this difficulty with a bold hand, and has not hesitated to declare as a probable explanation of the results obtained from the spectra of the reversing layer and chromosphere of the sun, that the elements exist there not in a molecular but in an atomic condition; and he further assumes that the metalloids exist in a more simple elementary condition than that in which we know them; their terrestrial existence being assumed to be that of compounds which have yet to be resolved into their constituents by our chemistry, though under the fierce chemistry of the sun it is only as thus resolved that they exist on his surface. It is startling for the chemist to be thus called upon to believe that enormous temperatures are endowed with a dissociating power, capable of not merely severing the bonds of ordinary chemical combination, but further of forcing into a condition of ultimate atomic disintegration composite molecules where these are the form under which the chemist has learnt to recognise the ordinary condition of even the isolated elements. Certainly the concordance of the heights to which the different gaseous elements rise in the reversing layer with the weights of the atoms of those elements as represented by their equivalents in the older chemistry, would lend something more than a justification to the even bolder hypothesis that recognises in the metalloids (such as silicon, sulphur, and oxygen, as they exist in our world) compounds of other and to our chemistry unknown elements, were we able to assert that the gaseous molecules of the metals in question, other than hydrogen, potassium, and sodium, must necessarily, like those of these elements, be double. It would be, in any case, a splendid result of solar physics to establish the nature of the gaseous molecules of so many elements that have as yet defied the experimental methods of our terrestrial laboratories. The banded character of the spectra of so many of these metalloids has lent a really important argument to Mr. Lockyer in his bold speculation as to their compound nature, in consequence of its parallelism with the case of compound gases, and his hypothesis has the merit of giving thus an explanation of the apparent absence of elements that every argument would lead us to look for, founded on a principle as ingenious as it is bold in its application.

The recognition by Mr. Huggins in the spectra of the stars of the lines belonging to hydrogen, sodium, magnesium, calcium, and iron, and of carbon compounds in comets and nebulæ, tends strongly to confirm the probability of a general identity in the chemical nature of the matter which pervades our universe; and further shows that the results of these investigations present no obstacle to our drawing any conclusion to which the logic of facts might otherwise guide us as to meteorolitic matter having been in its origin foreign to the solar system. Observations by v. Konkoly of the magnesium, sodium, and possibly also iron lines in the August meteoric swarm, like those by Alexander Herschel of the sodium line in those same St. Lawrence meteors, are of value as extending the coincidence in the elementary constitution of the sun, the stars, and meteorites, to those minuter forms of meteoric matter which, by their dispersion in the atmosphere, have hitherto been unattainable for the purposes of investigation.

In passing from the merely elementary components of meteorites to the chemical forms—that is to say, to the minerals in which these elements are grouped in them, we find ourselves in the presence of aggregates of crystallised minerals that at once remind us of our terrestrial rocks. At a first aspect they might easily be taken for rocks formed under conditions not very different from those of our globe. A closer inspection, however, brings out distinctive characters in these that evidence a very different set of conditions as having prevailed in the formation of the meteoric and the terrestrial rocks. Without going into minute mineralogical variations, and needlessly multiplying names, we may tabulate in a very short list the constituent minerals of the different sorts of meteorites. Several of these minerals are nearly identical in composition and crystallographic character with corresponding minerals met with in terrestrial rocks; others again are unknown, while some of them could hardly exist permanently as terrestrial minerals; and two present the composition of minerals familiar to us in our own rocks, but crystallographically distinct from these as belonging to different types of symmetry or "systems" from theirs.

In the Elementary Condition.

Iron with Nickel, traces of Cobalt and Copper, in some and probably in all cases with Hydrogen, Carbonic oxide, or other gases occluded in the metal.

Carbon (graphitic and plumbaginous).

Sulphur.

Compounds.

Ferrous Sulphide (*Troilite*)	FeS
Magnetic Pyrites	Fe_7S_8
Magnesium Sulphide ?	MgS
Calcium Sulphide (*Oldhamite*)	$Ca(Mg)S$
A Titanium—Calcium Sulphide (*Osbornite*)	?
Magnetite	Fe_3O_4
Chromite	$(FeCr)_3O_4$
Silica (orthorhombic as *Asmanite*)	SiO_2
,, (hexagonal as Quartz) ? }	
Tin Oxide }	SnO_2
Silicates, viz.:—	
Olivine varieties	$(Mg_{\frac{n}{m}}Fe_{\frac{m-n}{m}})_2SiO_4$
Enstatite	$MgSiO_3$
Bronzite varieties	$(Mg_{\frac{n}{m}}Fe_{\frac{m-n}{m}})SiO_3$
Augite varieties	$(Mg_{\frac{n}{m}}Ca_{\frac{m-n}{m}})SiO_3$
,, varieties containing corresponding ferrous silicate.	
Anorthite	$CaAl_2SiO_8$
Labradorite ?	
,, in tesseral forms (Tschermak's Maskelynite).	
Schreibersite varieties (phosphides of iron and nickel).	
Hydrocarbons (not yet sufficiently investigated).	

The names printed in italics are thus new to our mineralogy. The mineral to which I originally gave the name of Oldhamite is in all probability a mixture of two minerals—a Calcium Sulphide (which would be the pure Oldhamite) and a Magnesium Sulphide; and it is probable that they are not uncommon, though sparsely scattered, ingredients in freshly fallen meteorites, which, however, the action of a damp atmosphere rapidly decomposes into calcium sulphate or carbonate, and free sulphur, all which minerals occur in minute quantities occasionally in meteorites after they have been exposed to the weather.

Until the year 1867 the mineralogical department at the British Museum was without a laboratory, and chemical analyses could not be performed. I accordingly had recourse in 1861 to microscopic investigation as my only means of attacking the mineralogical problems presented by meteoric rocks. By the use of polarised light, of which the position of the plane of polarisation was accurately determined, it was possible, by the aid of an eyepiece goniometer and also of a revolving stage, to determine with some precision the directions of the principal sections in any of the minute sections of crystals which a fragment of a meteorite worked down to a thin transparent slice might present. Where such crystal sections happened to be approximately parallel to a zone plane, and the traces of the faces belonging to the zone could be seen with sufficient sharpness, or where cleavage planes occurred parallel or at recognisable inclinations to faces of the zone, important decisions could be arrived at by aid of polarised light. And this method is now becoming one of great importance to petrologists.

It was thus that I was enabled to anticipate with much confidence the orthorhombic character of one and the clinorhombic character of another ingredient (the enstatite and augite) in the Busti meteorite, and determine the cubic character of the oldhamite in that meteorite in 1862; and to be the first to announce the more than probability of enstatite (including of course, as the term then did, bronzite) being an important ingredient in meteorites; in the case of the Nellore meteorite in June 1863 and of that of Kaee in August 1864; a view confirmed afterwards (in November 1864) by Dr. Lawrence Smith on his repeating his analysis of the meteorite of Bishopville. Of the meteorites of Busti and of Manegaum, before they were cut, only minute fragments were at my disposal; and though in naming and first describing oldhamite in 1862, I had spoken of it as having all the appearance of being a "calcium galena," a small amount of probably sulphur and gypsum that separated in the watch-glass in which I made a qualitative investigation of it constrained me to say that I believed it to contain an excess of sulphur beyond that in the neutral sulphide.

Of the Manegaum meteorite also I employed only a minute fragment for investigation, and I attributed the bronzite of that meteorite to olivine, the section of the crystal examined not being really paralled to a zone-plane, and was confirmed in this error by finding the powdered bronzite not to be insoluble in acids. The addition of a laboratory to the department in 1867 enabled the long-desired analysis of the minerals I had separated to be made; and Dr. W. Flight being at my request appointed chemical assistant, I was able, with the help of his analytical skill, to complete the account of the minerals the presence of which in the meteorites in question had been determined so many years before.

The separated sulphur in the oldhamite proved, when a sufficient amount was taken for investigation, to be due to a superficial decomposition of the mineral, while bronzite was shown to be distinctly soluble in acid. The methods I adopted for the investigation of meteorites have since been employed by other observers, as well in the mode of using the directions of the principal sections of crystal-sections in the microscopic examination of terrestrial rocks as in the mode of attacking a meteorite by separating and isolating by toilsome microscopic selection its ingredient minerals; the plan by which the silicates in the Breitenbach siderolite and also those in fresh amounts from the Busti aërolite had been separated with a view to analysis in 1864 and 1865. Viktor von Lang, to whose assistance and to whose friendship I owe two or three of the most valued years of my life, while he was my colleague, measured, and some time afterwards published the account of the crystals of bronzite in the Breitenbach meteorite; the first occasion on which the crystallography of that mineral had been made out, only the system and approximate prism angle of the terrestrial bronzite and enstatite being previously known through the optical researches of Des Cloizeaux.

The form of asmanite, the orthorhombic variety of silica, occurring in the same meteorite, offered a difficult problem which I had taken in hand. One little crystal, however, carrying a portion of a zone with four consecutive faces, picked out in 1867, furnished the final key to its crystallography.

N. S. MASKELYNE

(*To be continued.*)

INSTINCT AND ACQUISITION.*

SO great was the influence of that school of psychology which maintained that we and all other animals had to acquire in the course of our individual lives all the knowledge and skill necessary for our preservation, that many of the very greatest authorities in science refused to believe in those instructive performances of young animals about which the less learned multitude have never had any doubt. For example, Helmholtz, than whom there is not, perhaps, any higher scientific authority, says: "The young chicken very soon pecks at grains of corn, but it pecked while it was still in the shell, and when it hears the hen peck, it pecks again, at first seemingly at random. Then, when it has by chance hit upon a grain, it may, no doubt, learn to notice the field of vision which is at the moment presented to it."

At the meeting of this Association in 1872, I gave a pretty full account of the behaviour of the chicken after its escape from the shell. The facts observed were conclusive against the individual-experience psychology. And they have, as far as I am aware, been received by scientific men without question. I would now add that not only does the chick not require to learn to peck at, to seize, and to swallow small specks of food, but that it is not a fact, as asserted, and generally supposed, that it pecks while still in the shell. The actual mode of self-delivery is just the reverse of pecking. Instead of striking forward and downward (a movement impossible on the part of a bird packed in a shell with its head under its wing), it breaks its way out by vigorously jerking its head upward, while it turns round within the shell, which is cut in two—chipped right round in a perfect circle some distance from the great end.

Though the instincts of animals appear and disappear in such seasonable correspondence with their own wants and the wants of their offspring as to be a standing subject of wonder, they have by no means the fixed and unalterable character by which some would distinguish them from the higher faculties of the human race. They vary in the individuals as does their physical structure. Animals can learn what they did not know by instinct and forget the instinctive knowledge which they never learned, while their instincts will often accommodate themselves to considerable changes in the order of external events. Everybody knows it to be a common practice to hatch ducks' eggs under the common hen, though in such cases the hen has to sit a week longer than on her own eggs. I tried an experiment to ascertain how far the time of sitting could be interfered with in the opposite direction. Two hens became broody on the same day, and I set them on dummies. On the third day I put two chicks a day old to one of the hens. She pecked at them once or twice; seemed rather fidgety, then took to them, called them to her and entered on all the cares of a mother. The other hen was similarly tried, but with a very different result. She pecked at the chickens viciously, and both that day and the next stubbornly refused to have anything to do with them.

The pig is an animal that has its wits about it quite as soon after birth as the chicken. I therefore selected it as a subject of observation. The following are some of my observations:—That vigorous young pigs get up and search for the teat at once, or within one minute after their entrance into the world. That if removed several feet from their mother, when aged only a few minutes, they soon find their way back to her, guided apparently by the grunting she makes in answer to their squeaking. In the case I observed the old sow rose in less than an hour and a half after pigging, and went out to eat; the pigs ran about, tried to eat various matters, followed their mother out, and sucked while she stood eating. One pig I put in a bag the moment it was born and kept it in the dark until it was seven hours old, when I placed it outside the sty, a distance of ten feet from where the sow lay concealed inside the house. The pig soon recognised the low grunting of its mother, went along outside the sty struggling to get under or over the lower bar. At the end of five minutes it succeeded in forcing itself through under the bar at one of the few places where that was possible. No sooner in than it went without a pause into the pig-house to its mother, and was at once like the others in its behaviour. Two little pigs I blindfolded at their birth. One of them I placed with its mother at once: it soon found the teat and began to suck. Six hours later I placed the other a little distance from the sow; it reached her in half a minute, after going about rather vaguely; in half a minute more it found the teat. Next day I found that one of the two left with the mother, blindfolded, had got the blinders off; the other was quite blind, walked about freely, knocking against things. In the afternoon I uncovered its eyes, and it went round and round as if it had had sight, and had suddenly lost it. In ten minutes it was scarcely distinguishable from one that had had sight all along. When placed on a chair it knew the height to require considering, went down on its knees and leapt down. When its eyes had been unveiled twenty minutes I placed it and another twenty feet from the sty. The two reached the mother in five minutes and at the same moment.

Different kinds of creatures, then, bring with them a good deal of cleverness, and a very useful acquaintance with the established order of nature. At the same time all of them later in their lives do a great many things of which they are quite incapable at birth. That these are all matters of pure acquisition appears to me an unwarranted assumption. The human infant cannot masticate; it can move its limbs, but cannot walk, or direct its hands so as to grasp an object held up before it. The kitten just born cannot catch mice. The newly hatched swallow or tomtit can neither walk, nor fly, nor feed itself. They are as helpless as the human infant. Is it as the result of painful learning that the child subsequently seizes an apple and eats it? that the cat lies in wait for the mouse? that the bird finds its proper food and wings its way through the air? We think not. With the development of the physical parts, comes, according to our view, the power to use them, in the ways that have preserved the race through past ages. This is in harmony with all we know. Not so the contrary view. So old is the feud between the cat and the dog, that the kitten knows its enemy even before it is able to see him, and when its fear can in no way serve it. One day last month, after fondling my dog, I put my hand into a basket containing four blind kittens, three days old. The smell my hand had carried with it set them puffing and spitting in a most comical fashion.

That the later developments to which I have referred are not acquisitions can be in some instances demonstrated. Birds do not *learn* to fly. Two years ago I shut up five unfledged swallows in a small box not much larger than the nest from which they were taken. The little box, which had a wire front, was hung on the wall near the nest, and the young swallows were fed by their parents through the wires. In this confinement, where they could not even extend their wings, they were kept until after they were fully fledged. Lord and Lady Amberley liberated the birds and communicated their observations to me, I being in another part of the country at the time. On going to set the prisoners free, one was found dead—they were all alive on the previous day. The remaining four were allowed to escape one at a time. Two of these were perceptibly wavering and unsteady in their flight. One of them, after a flight of about ninety yards, disappeared among some trees; the other, which flew more steadily, made a sweeping circuit in the air, after the manner of its kind, and alighted, or attempted to alight, on a branchless stump of a beech; at least it was no more seen. No. 3 (which was seen on the wing for about half a minute) flew near the ground, first round Wellingtonia, over to the other side of the kitchen-garden, past the bee-house, back to the lawn, round again, and into a beech-tree. No. 4 flew well near the ground, over a hedge twelve feet high to the kitchen-garden through an opening into the beeches, and was last seen close to the ground. The swallows never flew against anything, nor was there, in their avoiding objects, any appreciable difference between them and the old birds. No. 3 swept round the Wellingtonia, and No. 4 rose over the hedge just as we see the old swallows doing every hour of the day. I have this summer verified these observations. Of two swallows I had similarly confined, one, on being set free, flew a yard or two too close to the ground, rose in the direction of a beech-tree, which it gracefully avoided; it was seen for a considerable time sweeping round the beeches and performing magnificent evolutions in the air high above them. The other, which was observed to beat the air with its wings more than usual, was soon lost to sight behind some trees. Titmice, tomtits, and wrens I have made the subjects of a similar experiment and with similar results.

Again, every boy who has brought up nestlings with the hand

* Read at the Bristol meeting of the British Association.