

dissociation of the metals to which the lines are common in this case chiefly the metals of the iron group—in the hottest region of the sun, and to my mind the proof is conclusive that at that temperature we have a mixed mass of vapours, in which the base is more predominant than the so-called chemical elements to which that base is common.

But although behold that this is the most conclusive test to apply; it is not the only one which the sun affords us

We have every reason to believe that there is a considerable difference in the temperature of the spot- and storm-stratum when it is absolutely quiescent and cut off from all visible action from below, and again when it is riddled with convection currents of the most tremendous character—in other words that its temperature at the sun-spot maxima and minima is not the same. Hence we may imagine that the difference of temperature will affect the basic lines especially, and that they will be stronger at one period of the sun-spot curve than at another.

I limit myself for the present to the statement that this comparison has also been made to a certain extent, and that the result of it is entirely in harmony with what has gone before, so far as the observations go, but more spots must be observed before a complete discussion is possible. This, however, is certain, that basic lines widened at Sherman in 1872 were not observed widened at Greenwich in 1877, or at Kensington in the spots which appeared last month.

I for my part, then, am perforce driven by the stern logic of facts to the conclusion that these "basic lines" are not accidental; are not "physical coincidences;" and do not owe their origin to impurities; but that their appearance in two or more spectra is dependent upon high temperature merely.

The original statement, then, that the spectrum of each element consists only of lines special to that element, is found to be insufficient when the highest temperatures and the greatest dispersions are employed, and a "higher law" has to be introduced to bring the statements of the textbooks into harmony with the facts.

The dissociation of the elements of the iron group at the highest temperatures we can command and in the sun, is a cause by which this fact can be explained, if we accept the law of continuity, and reason on well based analogies.

This, of course, constitutes a new departure in spectrum analysis, whatever its bearing may be found to be upon Chemical Philosophy, when that subject is again studied as it once was.

To those who follow the line of reasoning on such a subject which the spectroscope provides us with, and even to those who admit the cogency of the conclusions, it will be astonishing that such a result has been arrived at in such an indirect way; there are, however, many minds so constituted that they will prefer to endow matter with any number of undreamt of qualities before they will accept such a solution.

But for all that, when the facts are well considered by competent authorities, it will, I think, be granted that an inorganic evolution is already glimpsed, in the study of which we shall not be baffled by any "breaks in strata."

J. NORMAN LOCKYER

MIND IN THE LOWER ANIMALS

Mind in the Lower Animals in Health and Disease. By W. Lauder Lindsay, M.D., F.R.S.E., F.L.S., &c. (London: C. Kegan Paul and Co., 1879.)

DR. LAUDER LINDSAY has long been known as a contributor to periodical literature in the province of comparative psychology. The work which he now publishes with the above title clearly represents a great amount of labour. It is in two large octavo volumes which together present somewhat over 1,000 pages, and contain references to the writings of about 200 authors. It is furnished with an excellent index and a bibliography. The latter, we are told, is "confined to works consulted by the author," and "almost exclusively to those published in Britain and in the English language." The work is also furnished with a long "enumeration of the animals whose character and habits form the basis of the author's generalisations." The list includes 908 species belonging to 516 genera, both the popular and the scientific names being in every case supplied.

In so extensive a work by so well-known a man there is, as we should expect, a great deal that is both of interest and value. Particularly in this connection may be pointed out his compilation and digestion of facts regarding the psychology of savages as contrasted with that of animals, and also many of his observations on the insanity of animals as compared with the insanity of man. His chapters on "General Adaptiveness" and "The Use of Instruments" also deserve, on the whole, to be commended.

But while we welcome a book—and especially a popular book—the leading object of which is to prove the kinship of animal intelligence to human, it is impossible not to regret the occurrence of certain faults which the exercise of a little more judgment might have obviated. In the first place the work is painfully diffuse. Whole pages, and even chapters, might with advantage have been omitted, while there are but few chapters which might not, with equal advantage, have been considerably condensed. Those, for instance, on "Faults of Terminology," "Animal Reputation," "Responsibility of Animals," and others, appear utterly useless. Whether or not it is accurate to call the lower animals "dumb," "lower," &c., and whether or not the "reputation" of a dog suffers from the use of such terms as "dogging," "hounding," "cat and dog life," &c., and whether or not any one is so foolish as to suppose that a smuggler's dog is morally responsible for a smuggler's acts; whether or not these things are so, they are certainly not of sufficient importance to demand lengthy discussion. Again, such statements as the following are quite superfluous, at least out of a nursery-book:—

"While the dog barks, bites, growls, howls, whines, sniffs, and snarls; the horse neighs, kicks, stamps, paws, snorts, champs, lashes its tail; the cat purrs, scratches, hisses, mews; cattle low, butt, gore, bellow; the elephant trumpets, roars, screams; the sheep and goat bleat; the ass brays, the cock crows, and the hen clucks and cackles."

This is all quite true, but it is not new; and the same remark is applicable to pages and pages of both volumes. In short, unlimited diffusiveness is the worst fault of the book. The next worst fault is that of presenting alleged

facts of animal intelligence on evidence that is obviously insufficient. Thus, for example, we are told that the hermit crab "has been noticed to feed the anemone (on his shell) with his pincer-like claws;" that ants "employ language of command;" that "snails are capable of concerted action;" that fish may die of "grief from bereavement;" that dogs exhibit "modesty or decency;" that monkeys "turn keys in doors, without noise, to secure themselves against interruption, discovery, or capture;" and so on, while in none of these cases are any facts or authorities given to support the assertions. Again, in many other cases where the facts and authorities are given, they are of a kind that ought not to have any place in a treatise which aims at a scientific discussion of its subject. For instance, we are told, without any expression of doubt on the part of the author, that "Daniell shows how a mere passing fancy for—a glimpse at—some dog, on the part of a pointer bitch, so impressed her memory and imagination that she transmitted this impress in a physical form to her progeny." Again, on no better authority than that of *The Animal World*—from which, indeed, Dr. Lindsay is very fond of quoting—we are expected to believe that "certain sparrows that failed, by seizing its wings with their bills, to lift a wounded companion, so as to convey it to a position of safety, got a twig, and while the maimed bird took hold of its centre by its bill, two of its companions seized, one each of its ends, so raised the helpless sparrow from the ground, and removed it to a safer place." And, to give only one other illustration, on the authority of an American paper called the *Christian Union*, we are told this painfully pathetic story:—"A young rat had fallen into a pail of pig-food; six older ones held a consultation so earnest in its character as to lead them to ignore the presence of human on-lookers. They decided on an ingenious scheme of rescue, and successfully carried it out. Entwining their legs together, they formed a chain, hanging downwards over the edge of the pail. The foremost or downmost rat grasped the drowning, and, as it subsequently proved, drowned, young one in its fore-paws, and both rescued and rescuer were then drawn up and out. When found to be dead, the rescuers gazed at their young comrade in 'mute despair,' wiped the tears from their eyes with their fore-paws, and departed without making any attempts to resuscitate it."

Evidently these rats were not acquainted with the Royal Humane Society's directions for the restoration of the apparently drowned, and considering that the calamity occurred in a civilised country, the most striking feature of the incident appears to be the ignorance which the animals displayed in yielding to grief "without making any attempts" to produce artificial respiration.

Another fault which pervades the work is that of undue eagerness to prove that no difference in kind exists between the mind of man and the mind of the lower animals—a fault which leads the author into the opposite error of disparaging such difference as does exist. Thus the book abounds with such statements as the following:—"There are countless thousands—many whole races—(of men) that are intellectually and morally the *inferiors* of many well-trained mammals, such as the chimpanzee, orang, dog, elephant, or horse; or birds, such as the parrot, starling, magpie, jackdaw, and various crows; as

well as many animals much lower in the zoological scale, and not trained by man at all, such as the ant, bee, and wasp." And this belief in the mental equality, or even superiority, of animals as compared with the lower races of man, is doubtless the explanation of the writer's tendency to attribute to rational thought actions of animals which are much more probably due to other causes. For instance: "A cat was found drowned in a pond immediately after the death of a master to whom it had been much attached. It had left the house on his illness a fortnight previously, refusing to enter it again (*Animal World*). The inference was that grief had led to deliberate self-destruction; but the verdict of accidental drowning, is, of course, equally permissible." The word "equally" here serves to illustrate our meaning.

With regard to references there is also a serious complaint to be made. It is not enough to give the name of an author without any reference to the part of his writings where his facts or opinions are stated. Thus, although Dr. Lindsay's pages are thickly strewn with the names of his authorities in brackets, his readers will but rarely have the opportunity, without an impracticable amount of trouble, of seeing exactly what these authorities themselves have to say on the topics in connection with which they are quoted.

On minor faults or errors it is needless to dwell—such as the curious notion which Dr. Lindsay seems to entertain, that the word "glutton" is derived from the synonym of the wolverine, instead of *vice versa* (p. 92). The chief faults are undoubtedly those which have been mentioned, and they have been mentioned in order to suggest that, should there be a second edition of the book, it would be greatly improved by presenting less diffusiveness and more discrimination than is presented by the first edition.

GEORGE J. ROMANES

OUR BOOK SHELF

An Atlas of Anatomy; or, Pictures of the Human Body, in Twenty-four Quarto Coloured Plates, comprising One Hundred Separate Figures. With descriptive Letterpress by Mrs. Fenwick Miller, Member of the London School Board, &c. (London: Edward Stanford, 1879.)

THIS work has been issued at a comparatively low price in the hope that it may be found useful both to science teachers and to all kinds of students. Children, we have it on the authority of Mrs. Miller, with their keen interest in the facts of Nature and with their fresh undistracted minds full of curiosity about what is around them, are always found to take a deep interest in the wonderful structure and functions of their own bodies. The subjects of anatomy and physiology have been introduced into many of the London Board Schools and have been found wonderfully popular among the children. An Inspector records that he has often been struck with the alacrity with which the children rush to their seats for an oral examination in physiology, even at the end of a long and tiring day of inspection. Truly such children must be very desirous to know all about themselves, and for such no doubt such a volume as this would prove quite an acceptable gift. Nearly all the drawings represented in the plates are new—never before published in any form in England. Some of them are from Dr. Heitzmann's Atlas, others are drawn from preparations in the Vienna Museum of Anatomy. In writing the letterpress the authoress had mainly in view the requirements of young students, and she has not assumed that any of her readers