and though they were stolen and melted down in 1802, faithful representations of them have been preserved. The horns were divided by projecting rings into a series of compartments, in nearly all of which there were groups of human and animal figures accompanied by various symbols. The meaning of these, Worsaae, by the light of northern mythology, has undertaken to interpret; and though it is impossible here even to attempt to reproduce his interpretation, it may fairly be said that it is one that commends itself for its consistency, and which the correspondence between the subjects on the two horns tends strongly to corroborate. There can, as he says, be scarcely a doubt that these gold horns, unique both in size and embellishment, originally formed a pair, and that, like other heathen representations in metal, stone, bone, or wood, they were a sort of sacred picture-book kept in a temple and intended to preserve the kernel of the old theology for the people. Accepting the view of certain marks and symbols being especially those of Thor, Odin, Frey, and other divinities, it is found that not only in later times did the Northmen cling with tenacity to their ancestral reverence for the images and sacred marks of their gods, but that in early times, even in the Bronze Age, traces may be discovered of similar objects of reverence, and that the whole system of northern mythology, such as it existed at the time of its supersession by the Christian faith, was but the development of religious ideas that had subsisted in the same regions in remote prehistoric times. Some speculations with regard to these sacred signs will also be found in our author's "Danish Arts" (p. 65 *et seq.*, p. 114).

The same may be said as to his views with regard to many of the deposits of arms and implements, both of stone and bronze, having originated from religious motives ("D. A." p. 63). It is certainly the case that considerable hoards of large flint axes, crescent-shaped knives of flint, and lance- or spear-heads of the same material, have been found deposited under large stones in fields and bogs, the uniformity of the objects in the deposit raising a presumption that it was not due to the mere hiding away of the private property of one individual, but rather to the fact that some offering to the gods was intended. In the case of hoards of bronze objects, there are some which comprise lumps of rough metal, old and worn-out implements, and even moulds. Such must, with all probability, be regarded as the property of bronze founders, hidden in the ground for the sake of security, and, from some cause or other, never afterwards recovered by the owners. There are, however, other deposits which, like those of stone already mentioned, would appear to have been due to a religious motive. In some instances the objects have been purposely broken and rendered useless, in the same manner as the gold Gaulish coins found in the Seine, which appear to have been offerings to the *Dea Sequana*, have been so constantly defaced. Such offerings to the divinities of springs and rivers were not unfrequent in Roman times, and continued in vogue even in later ages. The subject of the religious rites of the early prehistoric ages is, then, one the investigation of which has been fairly started by Worsaae, and offers a field in which future research may profitably be prosecuted.

The meaning and derivation of the devices on Scandinavian bracteates, which to a certain extent correspond

with the *bullæ* of the Romans, is also discussed in the book before us, which, though extending to little more than 200 pages, contains the result of much thought on the part of the author; and is suggestive of much more for the attentive reader.

It remains to say a few words with regard to the translator, who on the whole has done his work in a satisfactory manner, though probably a more intimate acquaintance with the Danish language and with Scandinavian archæology would have been advantageous. Such terms as grave-heights for barrows, or grave-mound^s, and the mention of a Society of Ancient Northern Texts, and the account of a discovery of relics of a primitive Stone Age in ancient chalk deposits under the earth's surface might have been avoided. But the most provoking part of the book is the author's or printer's misplaced economy in the matter of commas. Such a sentence as the following may serve as an example (p. 146): "Many other objects have been discovered in bogs and fields as well as in skeleton-graves from the close of the early Iron Age and from the middle Iron Age in Denmark, as for instance an angel of gold in deacon's robes an armlet with Christian symbols a ball of crystal a jewel carved with Christian Gnostic inscriptions in Greek ("Ablanathanalba," *i.e.* Thou art our Father) brooches mountings with barbarized semi-Christian ornaments, known also in other countries, and many others." But with all these slight defects the work of Worsaae still retains its full value, and English archæologists should gladly welcome its appearance in what Prof. Stephens, of Copenhagen, would call their "mother-tung."

JOHN EVANS.

PROFESSOR STOKES ON LIGHT.

Burnett Lectures. Third Course: On the Beneficial Effects of Light. By G. G. Stokes. (London: Macmillan and Co, 1887.)

THIS volume completes the course of the First Burnett Lecturer on the New Foundation. We have already (vol. xxix. p. 545, and vol. xxxii. p. 361) noticed the first two volumes; and we are now in a position to judge of the work as a whole. But we must first speak of the contents of the present volume.

The author commences by extending the term "Light" to radiation in general, and proceeds to a consideration of the effects which (unlike vision) are not merely beneficial to living things, whether plants or animals, but absolutely essential to their existence. Here, so far at least as matters suitable for an elementary work are concerned, there is not much room for novelty:—for the subject has of late been pretty well threshed out by various writers. Still, the mode of treatment adopted is of interest, especially that of marshalling our reasons for regarding all forms of radiation as due to one and the same agent.

"When we stand by some mighty waterfall, such for example as Niagara, and are struck by the grand exhibition of power that we see before us, we do not perhaps reflect that while it is through light that we are enabled to see what is going on, it is from light also that the energy is derived that we thus see in action."

Next comes a curious suggestion of analogy between the behaviour of fluorescent bodies (which always *degrade* the refrangibility of the light they give off) and the heat-radiation from bodies which have been exposed to sunlight. Sunlight, as it reaches us after passing through the atmosphere, is less rich in ultra-red rays than is the radiation from the majority of terrestrial sources; while the radiation from bodies which have been heated by direct sunlight is entirely ultra-red. Here we have, for the terrestrial atmosphere, the "green-house theory" which, in the second course, was applied to explain some of the singular phenomena exhibited by comets.

This is followed by an extremely interesting discussion of the functions of the colouring-matters of blood and of green leaves:—with the contrasted effects, upon plants, of total deprivation of light, and of continuously maintained illumination. A particularly valuable speculation, as to the probable nature of the behaviour of chlorophyll, is unfortunately too long for extraction.

So far, radiation has been treated without any special reference to vision. But the author proceeds to describe the physical functions and adaptations of the eye:—with particular reference to the arrangements for obviating such of the theoretical defects as, while involved in its general plan, *would also tend to diminish its practical usefulness*. The introduction of this obviously natural proviso, one which we do not recollect having seen prominently put forward till now, exhibits in a quite new light the intrinsic value of those objections to the "argument from design" which have been based upon the alleged imperfection of the eye as an optical instrument.

The analogy of fluorescence is once more introduced, but now for the purpose of suggesting a mechanical explanation of the mode in which the sense of vision is produced. This is brought forward after the modern photo-chemical theory of vision has been discussed. The latter is not altogether dismissed as improbable, but some of the more important difficulties which it raises are pointed out. The triplicity of the colour-sense, and the mechanism of single vision with two eyes, are treated at some length. But throughout this part of the work it is frankly confessed that there are many elementary questions, some of fundamental importance, which we are still unable even approximately to answer.

In his final chapter, the lecturer, in conformity with the terms of his appointment, discusses the *argument from design*. The origin of life, and the origin of species, are boldly (though all too briefly) treated:—next comes the question of the adaptation of physical structure, specially of course that of the eye, to the modes of life and the wants of animals.

"There is some very intimate connection between thinking, as we know it in ourselves, and the condition of the brain. So close is the connection that some have supposed that thinking is a mere function of the material organism, conditioned by nothing more than the motions of the molecules of which that organism consists. But surely this is going far beyond a legitimate inference from the observed facts. The body of a living animal is obedient to the laws of motion, the law of gravitation, and similar laws of the kind which belong to dead matter. But that does not prove that life is nothing more than a process depending on such laws. So if thinking be accompanied, as we know it in ourselves to be accom-

panied, by a state of activity of the material organism of which the body consists, that does not prove that thinking is nothing more than an action of the material organism. We have seen that life can only proceed from the living; may it not be in a similar manner that mind can only proceed from that which has mind? See what the contrary supposition leads us to. Here is man, in a geological sense a creature but of yesterday, utterly incapable of accounting for his own existence by any play of mere natural forces, and yet ignoring the existence of any mind higher than his own mind, though ready enough to admit the existence of unintelligent law, and that without limitations of time or space."

No higher praise need be bestowed on the scientific part of this third volume than is involved in saying that it is a worthy successor to the other two. Together, they form a singularly instructive, and yet (in the best sense) popular, treatise on a fascinating branch of natural philosophy. Were this their only aim, no one could deny that it has been thoroughly attained.

But their aim is of a loftier character. Here and there throughout the work there have been occasional references to the main purpose which has determined the author's mode of arranging his facts and his deductions from them. In the few closing pages this purpose is fully developed, and a brief but exceedingly clear statement shows at once how much in one sense, and yet how little in another, can be gathered as to the personality and the character of the Creator from a close and reverent study of His works.

These closing pages point out distinctly the danger alike of totally neglecting, and of too exclusively studying, the grandeur of nature. The first holder of this new post has set a noble example to his successors. He has supplied, not only to them but also, and we hope especially, to the rapidly-changing quaternion of neo-teleologists who will soon be set at work in the Scottish Universities, a warning which they will do well to lay to heart:—

"If we confine our attention to the study of nature in all its immensity, our conceptions of its Author are in danger of merging in a sort of pantheistic abstraction, in which the idea of personality is lost."

P. G. TAIT.

OUR BOOK SHELF.

Our Bird Allies. By Theodore Wood. (London: Society for Promoting Christian Knowledge, 1887.)

THE author of this little book holds that no British bird is utterly and wholly destructive, but that the misdeeds of even the most mischievous are atoned for in some degree by services rendered to us in other ways. Birds aid us, he points out, in three ways—first, by acting as scavengers, and destroying putrid matter; secondly, by devouring the seeds of the various wild plants which are so troublesome upon cultivated land; thirdly, and most important, by the slaughter of insects. The limitations of space have prevented Mr. Wood from mentioning all the birds he would have liked to describe, but he has found room for an account of most of the British birds which are especially beneficial. He writes simply, clearly, and with adequate knowledge; and there are probably few farmers who would not profit by studying what he has to say on a subject in which they ought to be strongly interested. He expresses his firm conviction that agriculture, as a profitable undertaking, is absolutely