his spirit, and the last of which contains all my own morality respect to the lower animals,—

O spare yon emmet, rich in hoarded grain,
He lives with pleasure, and he dies with pain.

I am aware that the doctrine assumed in the first line of the couplet in reference to the particular insect is denied by some naturalists; and that the fact assumed in the last line, in reference to the lower animals, is denied by others. Whatever be the truth as to the first point, I have no more doubt than I have of my own existence that some of the lower animals feel severe pain: and even if the words of our immortal Shakspeare as to the corporeal sufferance of the beetle trod upon be not literally accurate—yet who is entitled to affirm the contrary?—this, I think, is clear, that the child who is indulged in mutilating or killing an insect for his own pleasure has learnt the first lesson of inhumanity to his own species.

To revert however, for a minute, to the principle on which true results may be obtained from the observed variations of organs in the animal series, it is in the first place essential (I speak on the authority of Professor Owen, and, of course not on my own,) to determine the parts which truly answer to those, the functions of which it is the object of the comparative anatomist to elucidate. An elaborate and valuable contribution with this aim was communicated by Dr. Carpenter to the Physiological Section of this association, at its meeting at Southampton; having for its subject the homologies and functions of the parts of the *encephalon*.

It is needless to dwell on the obvious necessity of the knowledge of the essential nature,—signified by the true definition and name—of the part of the animal series, in order to ensure correct reasoning on the physiological import of the varieties of such parts. The British Association has already manifested its appreciation of the value and necessity of this preliminary step in comparative physiology by calling for the Report on the homologies of the vertebrate skeleton; and that Report, just published, is itself the best evidence of the importance of the subject, and a model of the mode in which it should be treated, and in which, happily for this Association, it has been treated by the Cuvier of England, Professor Owen.

In no department of the science of organized bodies, has the progress been greater or more assured than in that which relates to the microscopic structure of the constituent tissues of animal bodies, both in their healthy and in their morbid states; and this progress is specially marked in this country during the period which has elapsed since the communication to the British Association, by Pro- Owen, of his reseaches into the intimate structure of recent and fossil teeth.

The result of these researches having demonstrated the constancy of well-defined and clearly appreciable characters in the dental tissues of each species of animal, (by which characters such species could be determined, in many instances, by the examination of a fragment of a tooth), other observers have been stimulated to pursue the same minute inquiries into the diversities of structure of the tissue of other organs. Such inquiries, for example, have been most ably and successfully pursued by Dr. Carpenter in reference to the microscopic structure of recent and fossil shells; and the anatomist, the naturalist, and the palæontologist are alike indebted to the zeal and the skill of that eminent physiologist: while, in another sense, all are indebted to the British Association for aiding and stimulating his inquiries, and for the illustrations with which the publication of Dr. Carpenter's Report has been accompanied in the Transactions of the Association.

The *hairs* of the different mammalian animals offer to the microscopical anatomist a field of observation as richly and remarkably developed as the *teeth*, which formed the subject of Professor Owen's communication in 1838, and as the external coverings of the testaceous mollusca, which formed the subject of Dr. Carpenter's communication in 1846.

The structure of the softer tissues of the animal frame has not been less successfully investigated by microscopic observers. One of the-most extraordinary, perhaps, of the recent discoveries by the microscope is that which is due chiefly to Purkinge and Valentin, and which in this country has been well established by Dr. Sharpey, relative to the important part in the motion of fluids on internal surfaces, performed by the vibratile action of myriads of extremely minute hairs or cilia which beset those surfaces. These ciliary movements, for example, raise the mucus of the wind-pipe to the throat against gravity. They have been detected in the ventricles of the brain, as well as many other parts.

Microscopic anatomy has been chiefly indebted to Ehrenberg, Remak, and Dr. Martin Barry, for the exposition of the ultimate structure of the nervous and cerebral fibres.

Exact knowledge of the nature of the retina of the vitreous and crystalline humours, and of other delicate constituents of the organ of vision—the most wonderful of all the organs with which God has entrusted man—has been remarkably advanced by the skilful use of the improved microscopes of the present day. I rejoice that, among the proposed arrangements of the Association at its present meeting, one evening, will be specially devoted to an exhibition of microscopic objects. The beautiful discoveries of Sir David Brewster (whom, in this Association, we must always mention as one of our earliest friends and patrons, three times one of our Vice Presidents,) have been carefully confirmed; and many interesting varieties have been noticed in the structure of the crystalline lens of the eyes of different species of animals.

The most brilliant result, perhaps, of microscopic anatomical research has been the actual observation of the transit of the blood from the arteries to the veins; the last fact required—if, indeed, such an expression be allowable—for the full proof of Harvey's doctrine of the circulation of the blood. Malpighi first observed the transit in the large capillaries of the frog's web. It has since been observed in most other tissues, and in many other animals.

No part of the animal body has been the subject of more, or of more successful, researches than the blood itself. The forms and dimensions and diversities of structure characteristic of the coloured discs, corpuscles, or blood globules, as they were once termed, in the different classes, orders, and genera of animals, has been described, and for the most part accurately depicted; and, through the concurrence of numerous observers, the anatomical knowledge of these minute particles, invisible to the naked eye, has become as exact and precise as the knowledge of the blood vessels themselves, or of any other of the grosser and more conspicous systems of organs; and has added,—when we consider how easily the action is deranged, by how many causes it may be diseased or stopped,—another to the many proofs that we are fearfully as well as wonderfully made. In surveying how our frame is formed, how sustained, how revived by sleep, one of the most wondrous of all the incidents of our nature, what suffering is produced by any pressure on the lungs, and yet how unconsciously we breathe a million times in health for one in sickness,—I cannot but feel that our Heavenly Father gave another proof of His essential character when, in answer to the prayer of Moses, "Shew me Thy Glory," God answered, "I will cause *all my goodness* to pass before thee."

In no department of science has the confluence of its cultivators—at such annual meetings as the present—been more influential in advancing its progress in the right direction than in Natural History.

Natural History is pre-eminently the science of observation; a science made up of insulated facts and phenomena collected from the earth, the air, and the waters,—first carefully observed, and then distributed or generalized according to resemblances and analogies. Every fact, if it be deserving such a description,—that is to say, if it be truly observed and accurately stated—is welcome to the man of science, though the observer himself may not be in a condition to recognize the full signification of his own fact or its bearings on collateral phenomena. But if this be the case when one fact is communicated to one man of science, such particulars when communicated to an association like the present and discussed in its appropriate Section of scientific observers speedily gain their right place and do their duty in the steady advancement of natural science. The observer thus, for the first time, made cognizant of the full value and importance of his own observation, returns to his own locality and to his own particular department of science with renewed interest, with increased zeal, and, perhaps, also with a better direction given to his observation.

The rapid progress of the scientific knowledge of the animals of our own islands, and the great advance in the determination of the British Fauna, may be produced in illustration of the benefit which has followed these assemblages and the encouragement which the British Association, as a body, has given to the investigation of the facts and the publication of the results.

In no department of the living works of the Creator has this been more manifested than in that humble and, therefore, heretofore much neglected, class of the molluscous or gelatinous animals which people the seas around our island. Among the naturalists who have rescued this branch of zoology from neglect, the name of Edward Forbes deserves early and honorable mention. The stimulus given by his successful exertions with the dredge and with the towing net in collecting new species of Conchifera, Echinoderma and Acalepha, and the brilliant generalizations which he has deduced from the fruits of these researches, may be discerned in the beautiful monograph by Messrs. Alder and Hancock on the British Nudibranchiata, now in course of publication by the Ray Society—in the interesting work on British Zoophytes, just completed by Dr. Johnston—and in the new discoveries annually communicated to the Zoological Section of the British Association by Dr. Allman, Dr. Thompson, and other eminent naturalists, from Ireland; by Professor Goodsir, and other excellent observers in Scotland; by Mr. Price, as the fruit of his observations on the shores of Birkenhead; and by Mr. Peach, from the coasts of Cornwall. But the reports of the sectional meetings and those other Reports which have been suggested or encouraged by the grants of the British Association will best attest the influence of this Association in the promotion of natural history in general, and of home zoology in particular.

I canot utter one or two of the technical terms which I have lately addressed to the meeting without adding one passing reference to the great ancient authority from which they are derived; and which, high as its value is in its proper place in relation to those unchanged sciences of morals and mind, the cultivation of which is the distinguishing object of the academical education of Oxford, is also high even in natural science also: for, while the ethics of Aristotle remain the monument of his profound reason, his claim to eminence as a great observer of natural history remains also, after the experience of 2,000 years, unshaken and unalterable.

I proceed now to notice the science of BOTANY; which aided in these days by the microscope, and by chemistry as to the structure, functions and uses of the living plant, and as to the analogies in the vegetable world in its fossil state, presents one of the most interesting subjects of inquiry to the student and to the general observer.

Systematic Botany is constantly receiving additions to the number of species.