subjects of which we are at present in a state of comparative ignorance. If the inquiry produced no other immediate fruits than these, it would have performed a priceless service. Another result will be that we shall see for the first time what are the principles which should determine the action of the State for the advancement of science. At present there exists the most violent conflict of opinion on this subject, from those who hold that State intervention in science is unjustifiable and disadvantageous, to those who desire such intervention to be universal. Between these extremes there lies the middle and more reasonable section of thinkers, who recognise in the State simply a machinery for doing, on the part of the community, whatever is generally advantageous to the great mass of the people, but which transcends the power of individuals to perform. To discriminate fairly between the branches of scientific exertion which should devolve on the State and those which should be left to private energy, is one of the most valuable results that can be expected from the inquiry.

We may hope, as another most important result, that a central ministerial administration of scientific affairs will be shown to be necessary. In all other civilised countries a Minister of State is charged with this duty. It seems absolutely impossible to organise or maintain in an efficient state anything like a harmonious scientific system, without a dominant authority presiding over the whole. There are already indications of a coming Minister of Public Instruction, to administer the proposed national system of primary education; it can hardly be doubted that he should also have charge of whatever relates to State intervention in science.

The creation of such new scientific institutions as may be proved to be necessary, is another result that may be looked for. Though I have long been of opinion that the want exists, I do not think that the time has yet arrived to indicate how it should be supplied. The inquiry will develope clearer and more consistent estimates of the extent of the want, and of the best mode of meeting it, than, in the absence of full information regarding existing institutions, anyone can now hope to form. The cost of new scientific institutions alarms many persons who have only superficially examined such questions, but it will be probably found that increased expenditure in some directions may be met by retrenchment in others, and that no great change in the aggregate outlay on science will have to be made. On the other hand, we may feel sure that no outlay whatever will be recommended by a Royal Commission, unless it be incontrovertibly proved that such outlay will be beneficial to the nation.

Eventually, the responsibility of sanctioning increased expenditure for scientific purposes must rest with Parliament, by whom any proposals of that kind will be most scrupulously examined.

3. *The Constitution of the Commission.*—This is of vital importance. If its constitution be not such as to command, not only the confidence of the public generally, but also that of men of science, it cannot hope for success. The necessary elements in such a body seem to be administrative capacity, impartiality, and varied scientific knowledge. The first two elements will be secured by the nomination of persons versed in public affairs, and of high and independent station; the last by the due representation of the main branches of scientific activity. Probably four scientific members will suffice, to represent respectively, (1) Mathematics, including Astronomy; (2) Chemistry; (3) Physics; and (4) Natural History. To give a decided preponderance to either one of these great subdivisions will create strong and well-founded dissatisfaction. However lamentable the fact, it is certain that men engaged in one branch of science are very apt to underrate the importance of all others. The decision of a physiologist on an astronomical inquiry, or that of a mathematician on a matter connected with biology will be received with jealousy, a jealousy not by any means in most cases destitute of reasonable foundation. The subjects which will come before the Commission will be so difficult and so various, that four of the ablest men of science in their different departments will not be found more than will be necessary to give weight to the conclusions at which the Commission may arrive, and they should be men admittedly representative of their respective departments.

In the remarks which I have ventured to make, I have not dwelt on the importance to a civilised nation of progress in scientific knowledge. I have felt that I might safely take this for granted in addressing the Society of Arts, a society whose efforts have been during so long a period devoted to the promotion of such progress, and who do not require to be told that our commerce, our arts, our national supremacy on land and at sea, and our everyday conveniences are, more or less, dependent on our application of the laws of nature and the properties of matter. Whether or not an exhaustive inquiry into the state of science in England is imperatively needed, and what should be the scope of that inquiry, are the questions which, I believe, we have to-day met to discuss. It appears to me that the time for such an inquiry is opportune.

At no period of our history has there been so great a readiness to place administrative power in the hands of the Government. Public opinion acts now so energetically and effectually in the legislature, that the old jealousy of Government interference has been almost entirely dispelled. The tendency of the day is rather to impose fresh duties on the Government than to restrict its action. Men's minds, at the present time, view without apprehension, and examine with more impartiality and a higher discrimination than at any former period, proposals for radical changes. The nation has, moreover, been roused from the apathy with which it used to regard the ignorance of the masses, and is prepared for measures to redress the evil which, even ten years ago, would not have been listened to. It cannot be doubted that an equal readiness will be shown to examine with calmness and candour well-considered proposals to place on a proper footing a department of the State's duties which has never as yet undergone a strict and methodical examination. The nation requires primary education, and will enforce it upon those whom it is to benefit; it insists on the teaching of science in schools and universities; will it not approve of measures without which that teaching must be comparatively fruitless—measures calculated to attain the ends to which teaching is but a means—a more perfect knowledge of nature, and more absolute sway over her forces and her laws?

SCIENTIFIC SERIALS

THE *Student and Intellectual Observer*, New Series, No. 2, for April, contains an article entitled "Animals as Fellow-Boarders," being a translation of Von Beneden's valuable paper on *Commensalisme*, read before the Belgian Academy, describing the habits of creatures who may be said to board together, but whose association is distinct from that of victim and parasite. They are of two kinds, Free Fellow-Boarders, such as the tiny pea-crab, which lives in mussel-shells; and the Fixed Fellow-Boarders, like the barnacles which cover the skin of whales.

THE *Journal of Botany, British and Foreign*, New Series, No. 2 (double number for March and April) contains the following original articles: On two new British *Hepaticæ*, by Dr. Carrington; a fifth decade of new Chinese plants, by Dr. Hance; on *Rosa sepium*, by Mr. J. G. Baker; Addenda to the "Cybele Hibernica," by Mr. Ralph Tate; notes on Ray's "Hortus Siccus," by Dr. H. Trimen, with other shorter papers; also reports of recent additions to our moss and lichen flora, by Dr. Braithwaite and Rev. J. M. Crombie; a continuation of Mr. Baker's Review of the genus *Narcissus* from the *Gardener's Chronicle*, with other extracts and translations, reviews of new publications, proceedings of societies, &c., &c.

THE *Revue des Cours Scientifiques* for March 26 contains report of a Lecture by M. Paul Bert, on Sympathetic Nervous Actions, an article by Alph. Favre on the Existence of Man in the Tertiary Epoch, and a notice of Prof. Harkness's Spectroscopic Observations. The number for April 2nd is almost entirely filled by a translation of Prof. Tait's lecture before the University of Edinburgh, on the characters of a true science; and report of a lecture by M. Lorain at the Hospital Saint Antoine at Paris, on Scientific Medicine.

IN the *Deutsches Archiv für Klinisches Medicin* (xiii. and xvii. Heft. 1, received March 12), Liebermeister, of Basle, describes a very ingenious apparatus, constructed under his superintendence, for determining quantitative variations in the production of carbonic acid by man, and gives several examples of the results obtained. Amongst other conclusions he shows that the increase of carbonic acid in reading and singing is only to a small extent attributable to increased exertion consequent on fuller ventilation of the lungs, but is essentially due to the increased muscular energy exerted in the performance of those acts.

REICHERT and Dubois Reymond's *Archiv für Anatomie und Physiologie*, Heft. vi., 1869, is almost entirely occupied with a

valuable contribution by Dr. Gustav Fritsch, assistant in the anatomical museum at Berlin, on the comparative anatomy of the hearts of amphibia, illustrated by four plates and many drawings.

THE *American Naturalist* for March contains several interesting articles. The longest is by Mr. E. G. Squier, "On the Primeval Monuments of Peru compared with those in other parts of the world." He describes a class of stone structures in Peru belonging to what is regarded as the earliest monumental period, coincident in style and character with the cromlechs, dolmens, and "sun" or "Druidical" circles of Scandinavia, the British Islands, France, and Northern and Central Asia. Considerable aboriginal Peruvian tribes once lived in houses built on piles, or on floats in the shallow waters of the Andean lake. The remnants of such a tribe still live in this manner, and bear the name of Antis; they spoke and still speak a language differing equally from the Aymara and Quichua, called Puquina. Early chroniclers speak of them as extremely savage, and calling themselves, not men, but *Uros*. Whole towns of them, it is said, lived on floats of *tortora* or reeds, which they moved from place to place according to their convenience or necessities.—Prof. Joseph Leidy contributes remarks on some curious sponges; and Mr. W. W. Bailey a sketch of the Truckee and Humboldt valleys between the Sierra Nevada and the Rocky Mountains.

Silliman and Dana's American Journal of Science and Art for March contains the following articles:—Photometric Experiments, Part I., by O. N. Rood. Contributions to the Chemistry of Copper, Part I., by T. Sterry Hunt. Notice of a recent Land-slide on Mount Passaconaway, by G. H. Perkins. On the Silver Mines of Santa Eulalia, Mexico, by J. M. Kimball. Machinery and Processes of the Industrial Arts, and Apparatus of the Exact Sciences by F. A. P. Barnard. On Norite or Labradorite Rock, by T. Sterry Hunt. On the Cause of the colour of the water of Lake Leman, by A. A. Hayes. On the Potassio-Cobaltic Nitrite known as Fischer's Salt, by S. P. Sadtler. Notice of some Fossil Birds from the Cretaceous and Tertiary formations of the United States, by O. C. Marsh. Descriptions of Shells, from the Gulf of California, by A. E. Verrill. Notice of Dr. Gould's Report on the Transatlantic Longitude. Meteors of November, 1869, by Prof. H. A. Newton.

SOCIETIES AND ACADEMIES

LONDON

Ethnological Society, March 22.—Prof. Huxley, F.R.S., president, in the chair. Mr. R. S. Newall was announced as a new member.—A paper was read on current British Mythology and Oral Tradition, by Mr. J. F. Campbell (of Islay). After explaining the sources whence his popular tales of the Western Highlands had been derived, he referred to the traditional character of myths, and expressed an opinion that many genuine British traditions orally preserved in Celtic may probably be old Aryan myths, mingled perhaps with pre-Aryan myths. Popular oral history must be founded on a real event, but minor details gradually drop out, while the most conspicuous incidents approach each other. The author showed how a legend sprouts from a fact which, being at first accurately told, passes into a tradition, while the dates and persons and localities become uncertain. Poetry is a good vehicle for preserving facts, and many current traditions carry with them a rhyme or a proverb to aid the memory. Hence, too, historic events are readily preserved in the ballad form. The president, Dr. Archibald Campbell, and Mr. Bouverie Pusey spoke upon this communication.—Dr. Campbell then read a note by the Rev. R. J. Mapleton on a Cist with Engraved Stones on the Poltallock Estate, Argyleshire.

Zoological Society, March 24.—Dr. E. Hamilton, V.P., in the chair. Mr. P. L. Sclater exhibited a coloured drawing received from Dr. Salvadori, of Turin, of a bird which Dr. Salvadori had proposed to describe as a new genus and species, but which was evidently referable to the singular pigeon recently named by Mr. Gould as *Otidiphaps nobilis*.—Mr. W. B. Tegetmeier exhibited and made remarks on a living specimen of an Axolotl (*Siredon pisciformis*) which had undergone the change into the Salamandroid form recently described by Professor Dumeril, of Paris.—A third letter was read from Mr. W. H. Hudson, containing remarks on the ornithology of the vicinity of Buenos Ayres.—Mr. Osbert Salvin read a paper on the birds of Veragua, based on large collections recently formed by Enrique Arce in that country, and in continuation of a former memoir on the same subject. The present communication contained an account of 214 species not given in the former list, and made altogether 434 species now known to occur in this limited district. Of these additional species several were stated to be new to science and of great interest.—Mr. P. L. Sclater read a notice of two rare species of pheasants from Upper Assam recently added to the society's living collection. These were a Monaul (*Lophophorus sclateri*) and a Tragopan (*Ceriornis blythii*), both lately described as new by Dr. Jerdon. For these specimens, both of which were in fine plumage and of very remarkable beauty, the society was indebted to the liberality of Major Montagu, of the Bengal Staff Corps.—Mr. P. L. Sclater read some further notes on the cuckoos of the genus *Coccyzus*, in continuation of a former paper on the same subject.—A communication was read from Professor J. V. Barboza du Bocage, containing a description of a new species of pelican from Angola, proposed to be called *P. sharpii*.—A communication was read from Dr. J. C. Cox, giving descriptions of eight new species of shells from Australia and the Solomon Islands.—A communication was read from Mr. Jonathan Couch, of Polperro, describing a new species of *Aplysia* or sea-hare, which had recently occurred on the coast of Cornwall, and which he proposed to call *A. melanopus*.

Chemical Society, March 17.—Prof. Williamson, F.R.S., president, in the chair. The following gentlemen were elected fellows: D. Brown, A. Muirhead, T. L. Patterson, D. Penny, S. T. Smith. The first paper read was on artificial alizarine, by W. H. Perkins, F.R.S. The lecturer commenced by sketching the history of the researches which had finally led to the artificial production of alizarine. This colouring matter was first obtained by Robiquet and Colin from madder root, and investigated by Schunk, who assigned to it the formula $C_{14}H_{10}O_4$; it will subsequently be seen how very near this formula comes to the truth. Strecker and other chemists had reasons to write $C_{10}H_6O_3$ as the composition of alizarine, relating it to the compound $C_{10}H_5ClO_3$ which Laurent had produced from naphtaline, and which Strecker regarded as chloralizarine. A few years since Graebe, when investigating a hydrocarbon known as quinone, $C_6H_4O_2$, found it to be a benzol in which two atoms of hydrogen were replaced by the group $[O-O]''$. A derivative of this body, the chloranil, $C_6Cl_4[O_2]''$ yields hydric chloranilate on successive treatment with caustic potash and hydric chloride. This reaction induced Graebe to view the chloride of Laurent's chloroxynaphtalic acid as the dichlorinated quinone of naphtaline,—

$C_{10}H_8$	$C_{10}H_4Cl_2[O_2]''$
Naphtaline.	Chloride of chloroxynaphtalic acid or Dichlornaphtoquinone.

and indeed when this naphtaline derivative is acted upon successively by potash and hydric chloride, it furnishes chloroxynaphtalic acid. After it had thus been shown that chloroxynaphtalic acid, Strecker's chloralizarine, was a quinone acid, Graebe and Liebermann thought it probable that alizarine might also be the quinone acid of some hydrocarbon, and it was now only necessary to know this hydrocarbon. On reducing a specimen of natural alizarine, a substance of the composition $C_{14}H_{10}$ was obtained; but this is the formula of anthracene of coal tar, and indeed the substance obtained by the reduction of alizarine possessed all the properties of anthracene. This fact led Graebe and Liebermann to assume alizarine to be the quinone acid of anthracene,—

$C_{14}H_{10}$	$C_{14}H_8(O_2)''$	$C_{14}H_6\begin{cases}(O_2)''\\HO\\HO\end{cases}$
Anthracene	Quinone of anthracene or Anthraquinone.	Anthraquinonic acid or Alizarine.

Having obtained anthracene from alizarine, it now remained to produce alizarine from anthracene. For this purpose it was first required to have the quinone of anthracene. Graebe and Liebermann found the desired substance in the oxygenated compound, $C_{14}H_8O_2$, which had been obtained by Laurent from anthracene. They heated this anthraquinone with bromine, acted upon the dibromanthraquinone thus gained with potash, and decomposed the potash salt thus obtained by hydric chloride. The product of these successive reactions was alizarine. But to turn this beautiful discovery to practical account, it was necessary to replace the bromine required in the process by some cheaper re-agent. A good substitute has been found in sulphuric acid.