transformation than that which actually takes place in the life of every frog and toad. Born almost a lamprey, it changes into a creature which is a Selachian, and something more; for it passes through the further border of the sharks and skates, in their territory, and begins in its changing growth to make the rudiments, at least, of many an important organ which comes to its perfection in man and his nearest relatives. The growth force then fetching in improvements and additions from many a quarter, and combining all things skilfully, makes a new thing on the earth.

(*To be continued.*)

THE NEWEST EXPLOSIVE

GUN-COTTON and dynamite, which have for some years past held the foremost rank among modern explosives, are no longer, it seems, to retain this honour undisputed. A compound more violent still than either of these well-known preparations has lately been given to the world by M. Nobel in the shape of blasting-gelatine, and blasting-gelatine, again, has been endowed with still greater energy by a modification in its nature, effected by Prof. Abel, the War Department chemist. So far as experiment has shown, the gelatine and modified gelatine are, without doubt, the most active explosive agents known to us, or, in other words, a given weight of these compounds will work more destruction upon metal, stone, or other unyielding mass, than any of the hundred and one bodies of a like character with which we have become acquainted during the past half-century.

It is a well-known circumstance that, with but very few exceptions, the many explosives that have lately been brought before the public under a variety of names are merely modifications of one and the same thing. They are all nitro-compounds, or modifications of them. One class owe their origin to gun-cotton and the other to nitro-glycerine, and gun-cotton and nitro-glycerine are by the chemist regarded as the same thing. Gun-cotton is made by the nitrification of a solid body, and nitro-glycerine by the nitrification of a liquid body. The methods of manufacture are similar, and the agents employed to bring about the nitrification are the same. In the one instance a woody fibre—cellulose—is acted upon by a mixture of strong nitric acid and sulphuric acid, the former liquid to perform the operation of nitrification, by substituting certain equivalents of nitrogen for the hydrogen existing in the cellulose, and the latter acid for the purpose of absorbing any moisture given off in the substitution process, and thus preventing the nitric acid from becoming dilute and inefficient. In the other, a liquid—glycerine—is permitted to combine in small quantities at a time with a mixture of the same acids, and in like manner parts with its hydrogen, to be replaced by nitrogen.

There is, however, this wide difference in the application of the two compounds. Gun-cotton may be employed as it stands, and the Abel gun-cotton that is used by our soldiers and sailors for torpedoes and mining work is simply a pure pyroxilin, pulped fine to permit of its being thoroughly washed, and compressed into *papier-maché* sort of blocks, for the sake of convenience. Nitro-glycerine, on the other hand, being a liquid, is difficult to handle in that form, and for this reason it is that Nobel and others cast about for suitable vehicles to contain the preparation. A siliceous clay called Kieselguhr, which will absorb three times its weight of the liquid, has been found the most favourable substance, and dynamite, generally speaking, may be said to consist of 75 per cent. of nitro-glycerine and 25 per cent. of this inert substance. In lithofracteur, other substances besides, are employed, such as powdered charcoal and nitre, and there now exists a whole family of such combinations, none of which contain, however, more than 75 per cent. of the active explosive, nitro-glycerine.

In blasting gelatine, which, by the way, contains no gelatine at all, the objection to employing an inert material is got rid of altogether, and the mass, like compressed gun-cotton, is explosive and combustible throughout. Blasting, or explosive, gelatine is a mixture of nitro-glycerine and gun-cotton. M. Nobel, to whom is due the credit of having placed the valuable properties of nitro-glycerine at the disposal of mining-engineers, has discovered, in the pursuance of further investigations, that the liquid in question acts as a solvent upon gun-cotton. Like a mixture of alcohol and ether, nitro-glycerine is found to dissolve nitro-cellulose, and form a description of collodion, or, as M. Nobel terms it, gelatine. It is not, of course, the highly-explosive gun-cotton that will thus dissolve, but that known as photographer's pyroxilin, which does not contain so much nitrogen. Military gun-cotton, indeed, or tri-nitro-cellulose, to call it by its chemical name, should not be soluble at all, or at any rate only to a slight extent, if properly manufactured, and one of the tests to ascertain if it is of good quality is in fact to treat it with an alcohol-ether mixture to ascertain how far it will dissolve. The soluble gun-cotton, however, if not so highly nitrified, to coin a term for our purpose, is still a sufficiently explosive body, and this M. Nobel finds he can dissolve to a greater extent in nitro-glycerine than it is possible to do in alcohol and ether. Whereas the latter will dissolve no more than 4 or 5 per cent. of pyroxiline, and frequently less than 2, nitro-glycerine has been found to take up upwards of 7 per cent. The operation of dissolving is presumably done when the liquid is warm, and the result is, as we have said, a jellified mass, which has all the attributes of a definite combination. There is no separation of liquid from the mass, and cartridges may be made by simply rolling up the material in paper envelopes.

Thus, in blasting gelatine, there is no inert body, and the consequence is that weight for weight, the gelatine is superior in its destructive action to dynamite. The latter, as we have seen, contains 75 per cent. of nitro-glycerine, whereas blasting gelatine consists of from 90 to 93 per cent. of this liquid, and from 7 to 10 per cent. of soluble gun-cotton. But there exists another reason still, why the detonation of blasting gelatine should be more energetic, namely, because the combustion of the charge, from more perfect oxidation, is well nigh perfect. Prof. Abel pointed this out very clearly in his recent lecture at the Royal Institution. "As nitro-glycerine," he said, "contains a small amount of oxygen in excess of that required for the perfect oxidation of its carbon and hydrogen constituents, while the soluble gun-cotton is deficient in the requisite oxygen for its complete transformation into thoroughly oxidised products, the result of an incorporation of the latter in small proportions with nitro-glycerine, is the production of an explosive agent, which contains the proportion of oxygen requisite for the development of the *maximum* of chemical energy by the complete burning of the carbon and hydrogen; and hence," Prof. Abel concludes, "blasting gelatine should, theoretically, be even slightly more powerful as an explosive agent than pure nitro-glycerine."

By converting the gelatine into a more solid body by the addition to it of some 10 per cent. of military gun-cotton, or tri-nitro-cellulose, Mr. Abel appears to have secured a still more vigorous explosive, and one besides, that, by reason of its firmness, is more convenient to handle than the softer and pliant jelly. The destructive action of this modified gelatine upon iron plates and heavy masses of lead, has been found greater than that of any other form of nitro-glycerine or gun-cotton, and there is no room for doubt that for torpedoes and military mining, where the object is to secure the greatest degree of violence, regardless of consequences, the compound will find valuable application.

While on the subject of nitro-glycerine and its behaviour

as a detonating agent, a few words may be said upon the report of the Chief Inspector of Explosives that has just been issued by the Home Office. If only because it controverts a popular notion as to the dangers of this substance in a frozen state, the report in question is of considerable interest. Ever since the disastrous accident at Newcastle-upon-Tyne, when Mr. Mawson, the mayor of the city and several others lost their lives through the explosion of some packages supposed to have contained frozen nitro-glycerine, a wholesome dread of this substance has been entertained. But, strange to say, Major Majendie and Mr. E. O. Brown, of Woolwich, who appears to have been associated with the Chief Inspector in these experiments with frozen nitro-glycerine, found the latter far less sensitive either to blows or to fulminate powder than when in its ordinary condition. In some cases the frozen material allowed itself to be scattered by the violence used, without detonating at all, and it was only by using a very large charge of fulminate powder that its explosion succeeded. Frozen dynamite was still more obstinate, and under some circumstances, indeed, its detonation appeared almost impossible. Another circumstance of an unexpected character presented itself in these experiments. Mr. Brown found that the solidification of nitro-glycerine—a phenomenon that usually happens very readily some degrees above the freezing-point of water—is particularly difficult to bring about when the liquid is in a pure state. Continued subjection of the pure liquid to a temperature below freezing-point failed altogether to effect its solidification, and it was only upon the addition of a few grains of a solid body that the desired result was secured. The reason, therefore, why commercial nitro-glycerine so readily solidifies at a comparatively high temperature is obviously because it is not perfectly pure. H. BADEN PRITCHARD

THE BRITISH MUSEUM LIBRARY

IN NATURE, vol. xix. p. 253, attention was drawn to the state of the literature of science as available for reference in the library of the British Museum. The publications of scientific societies, home, colonial, and foreign, and those of the scientific departments of different governments, were especially mentioned both as defective in regard to completeness of series, and as difficult to find in the catalogue.

Pending steps being taken to secure some approximation to completeness of series, which must take time, it may be useful to offer some suggestions with regard to the cataloguing, a modification in which would save much time to readers. Any fundamental alteration would no doubt be undesirable, for from a librarian's point of view, the cataloguing at the British Museum has been so often pronounced excellent. There is, however, also the worker's point of view, and if the catalogue is not one which, after years of experience he can easily use, it is not to be accounted as perfect.

The simplest solution of the present difficulty would be to have printed a separate list, such as the Patent Office periodically prints, "a list of the scientific and other periodicals and transactions of learned societies in the free library." Should there be, however, a financial difficulty in the way of carrying this out, it would be a saving of time to readers if these transactions, proceedings, &c., of societies were entered in some distinctive way, such as by a coloured ink, or even by a stroke in the margin, so that they might be easily picked out from bye-laws, lists of members, reprints of separate papers, &c. Several of the older societies occupy many pages in the special catalogue "academies." It is the publication of the societies containing the papers that are, of course, most frequently wanted, but these are so mixed up with other entries, that it takes time to find their press mark. Further than that, different series, when such exist, have different press marks, and it is not every one who has a date and a volume number for reference that knows whether there is more than one series, so a wrong press-mark may be given. In some cases there are two or three sets, more or less incomplete, of a series of publications, some, perhaps, in the King's library, some in the Granville, some in the general library, &c. This is very confusing, as it is only in a few cases that any note is made of the extent of incompleteness, and if the wrong set should be written for, it involves the loss of at least half an hour, and on busy days probably an hour.

If all the serial publications of a society were given at the head of the entries of that society, or even if only marked in the margin as just suggested, it would save a reader much time in finding the press mark, and would also save still further time often by giving the press mark for the part of the series which contains the volume wanted.

There is another point which is worth consideration, and that is whether those who are known to use the library for purposes of research could not be in some way put on a different footing from those who go simply to read. It would not be an innovation, but only an extension of a principle already recognised. For example, if a reader wishes to consult certain MSS., he is taken into a separate room, if he wishes to consult some of the older or rarer books, there is another room for such purpose, and there is but little time wasted in bringing him what he wants. Students are admitted to the natural history collections on days when they are closed to the public. There are a large number of people who use the museum for other purposes than work. They write their letters, read their magazines and newspapers, go round among their friends and gossip, write a ticket for some interesting book of travel or a novel, and read bits of it in the interval of receiving visits. Not a few appear to go there for a rest. The objection to all this is that these people occupy seats, and it is becoming more and more difficult for a reader with many books out at once for consultation or search to find table space. It is a very trying thing for a writer with references to verify or to follow up, to see while he is waiting for his books that the time of attendants is occupied in fetching novels that can be bought at any railway book-stall, or pieces of music that can be obtained for a few pence. (It may be mentioned in passing that for the cataloguing of comic songs and dance music, the British Museum is unsurpassed in excellence.) It must require a strong sense of the immorality of making quotations or references second-hand, to give a man patience under the circumstances. If the works are wanted for reading there is of course no help but waiting.

Surely there might be some distinction made between those who go to the reading-room for systematic work, and those who go for amusement. The British Museum reading-room is something more than a library for Londoners; people come up to town on purpose to consult it. It is a national library. An average mechanics' Institute would supply the wants of many who now use the Museum, occupy seats there, and take up the time of attendants. There are other free libraries in London besides the British Museum.

If it is not found practicable to make a distinction for workers generally it might be worth while to try how it would do to have tickets of a special colour for "Academies" and that these should not be obliged to wait their turn with tickets for novels. There are already white and coloured slips in use.

It would be a great advantage if the publications of societies and scientific departments of governments were kept all together and placed directly under the care of an officer who should see to their being kept up in completeness.

ON THE FIGURE OF THE EARTH

THE columns of NATURE recently contained an interesting series of articles on this subject, with notes. One of these notes, which I here repeat, has a