dreds of millions of pounds are being expended in covering the earth with telegraphs, and thousands of millions in covering it with railways, gasworks, waterworks, &c., and Birmingham and its district has its share in supplying the rails, the wire, and the machinery. In this country alone more than 550,000,000 of pounds have been already expended upon railways only. *Original scientific research is the great fountain-head of industry*, and its capability of developing increased trade is practically unlimited: it is at present quite in its infancy, and we are only on the very threshold of a knowledge of the forces of nature, and of the constitution of material substances; and if such enormous results are being produced by the beginnings of unaided science, what may be expected from its future developments, especially if scientific research is assisted in an effectual manner?

"Numerous important subjects of investigation, capable of yielding valuable results bearing upon the trades of this town, exist in all directions. Researches in electricity and in inorganic chemistry, particularly the metals and their compounds, would probably lead, as they have done before, to the establishment of new trades, and to improvements in local manufactures, and thus lay the foundation of future commercial prosperity. Discoveries in science, however, are best made, not by trying to obtain some valuable commercial or technical result (that object belongs to an inventor), but by making new, reliable, and systematic investigations. By investigating the chemical action of electricity upon saline bodies, Sir Humphry Davy isolated sodium and magnesium, which has led to the recent establishment in Manchester of the manufactures of those metals. By the abstract researches of Hofmann and others upon coal-tar, the immensely profitable manufacture of the splendid coal-tar dyes was originated.

"Scientific discovery is the most valuable in its ultimate practical results when it is pursued from a love of truth as the ruling motive, and any attempt to make it more directly and quickly remunerative, by trying to direct it into practical channels, will decrease the importance of its results, diminish the spirit of inquiry, and sooner or later reduce it to the character of invention. The greatest practical realities of this age had their origin, not in invention or a search for utilities, but in a search after important new truths, entirely irrespective of what utilities they might lead to.

"I do not intend by these remarks to imply that any new trades or improvements in manufactures have been or can be effected without the labours of inventors and practical men; but that there should be a more judicious division of labour, one man to discover new truths, another to put them into the form of practical inventions, and the practical business-man to work them; because it is proved by experience that in nearly all cases these different kinds of labour require men of widely different habits of mind, and that the faculties of discovery, invention, and practical manufacture, are very rarely united in one man.

"Our large manufacturers and men of business have accepted and employed the advantages of science in an endless number of ways in their occupations, and have thereby acquired great wealth; but, notwithstanding this, and that the greatest trades of this district were originated and improved largely by means of scientific investigation, scarcely any of the wealthy manufacturers or landholders of the locality, who have derived such great benefits from the increase of trades, give the least assistance to scientific research; that which is the duty of all has been attended to by none. The probable explanation is, original scientific research is a subject quite outside the experience and knowledge of persons in general. It may be objected that such research is not aided, because it sometimes takes a long time to acquire a practical shape and make it pay. We do not omit to plant an acorn because it requires many years to become an oak; we do not neglect to rear

a child because he may not live to become a man; but we leave scientific discovery to take care of itself."

England's present and special weakness is then referred to:—

"Our practice with regard to science is very different from the plan carried out in Germany. Within the last few years great laboratories have been erected in Berlin, Leipzig, Aix la Chapelle, Bonn, Karlsruhe, Stuttgart, Griefswald, and other places, at the expense of the State, and special provision has been made in them for original scientific research. A glance at the frequently published list of scientific investigations made in different countries will show us that the Germans are making a far greater number of discoveries in science than ourselves. If we are to maintain our position as a manufacturing nation, we also must adopt special means to promote scientific research; for how can we expect to obtain new arts and manufactures, or improvements in old ones, if we do not make new discoveries in the properties of matter and its forces? I need not multiply instances of the essential dependence of our present commercial success upon abstract scientific research, but may safely affirm that nearly all our great manufactures have been originated by means of experiment, observation, and study of matter and its forces; and that the great bulk of the improvements made in manufactures by practical men could not have been effected had not scientific investigators discovered, and made known in books, the properties of bodies. The inference from these conclusions is obvious: by adopting similar means, but in a more effectual way, we shall obtain similar but more successful results."

And this being so, what is the actual condition of things? According to Mr. Gore, "at present, original scientific researches are generally made by teachers of science, who spend a portion of their scanty incomes in making experiments, and lead lives of great self-denial in the labour. There is absolutely no provision in this country for the support of scientific investigators, and thus the great source of new trades and improvements in manufactures remains undeveloped."

Surely if scientific men are convinced, first, that the future of our national industries depends upon research, and secondly, that there is no research, the time has arrived when action of some sort is incumbent upon them if they are ever to take action in any subject whatever; for it is perfectly obvious that any bettering of such a state of things can only proceed from the action of the scientific men themselves.

We have let Mr. Gore speak for himself thus at length, as in his article there is ample endorsement of much that has already appeared in this journal, but he is by no means the only witness that we can appeal to. Even the President of the Chemical Society is compelled to acknowledge that the original researches brought before that Society have fallen nearly to zero. Commenting on this, the *British Medical Journal* points out that the institutions which were formerly considered the homes of research, are now silent. If these things be true, then if those who hold that research is a national necessity are right, our future position is not far to seek.

THE HIGHLANDS OF CENTRAL INDIA

The Highlands of Central India. By Captain J. Forsyth, Bengal Staff Corps. (London: Chapman and Hall.)

THIS is a book descriptive of that great tract of hill and forest country which is situated in the very centre of the Indian Peninsula, and whose drainage forms

the headwaters of the Nerbada, the Tapti, the Sone, and affluents of the Mahanadi.

The author, who, in the course of his professional duties, acquired a close and intimate acquaintance with the country and its inhabitants, commences by giving a sketch of the probable history of the various races found in this wild and, until lately, almost unexplored country—races whose ethnological and religious history possess peculiar interest; because here the Aboriginal tribes, the races of mixed Aryan and Aboriginal blood, and the Hindoos proper, can be found living side by side; and the effects of the colonisation of the district by the Aryans of Hindustan can be traced out with some degree of clearness.

A considerable portion of the book is devoted to the author's sporting experiences. These he relates in a lively and spirited style; but as the reminiscences of Indian sportsmen have a strong family likeness, this part of the book does not call for much notice, except that the author appears to make rather too light of the danger of bison-shooting, and makes some statements concerning this game which are scarcely correct, one of these statements being that the animal is always known under the name of *bhinsa*, or more correctly *bhainsa* (a word resembling in sound the English word bison), and never as *gaur*. Now in the very district of Northern Belaspur which the author describes in the latter portion of the book, there is a high and prominent hill much frequented by these animals, and called in consequence Gaur-duari, or the pass of the bison. The author also appears to confound the bison of Central India with the similar but not identical animal, known as the Mithan or Mithna, found on the hill ranges of Eastern and North-Eastern Bengal.

From the description given of some of the shrines and pilgrimages met with in these hill districts, an idea may be formed of the way in which the Hinduism of Hindustan proper has been localised; and how the scenes of some of the principal events of Hindu mythology have been transferred from the Ganges and Jumna to the Nerbada and its adjacent heights.

The latter portion of the volume is devoted in a great measure to the country lying under and east of the Mykul range; that is the range which, according to the author's definition, forms the eastern boundary of the Highlands of Central India. This tract of country is remarkable, because it presents, perhaps, the greatest sweep of unbroken jungle and forest to be found in India south of the Ganges and Brahmaputra. It is neither plain nor hill, but rocky with gentle undulations, and covered with forest. Only a few miserable villages are found throughout the whole country; just enough to make its wildness and desolation more striking. Such a country, unfitted by nature for cultivation, and exhaling a deadly malaria, must long remain the home of the elephant, the tiger, and of the animals on which the latter preys; nor are there found any remains or traditions which would indicate that the place had ever been more thickly populated than it is at present. Here man is the inferior animal, and the wild elephant is the lord of the country. He roams at will from place to place, and, just when the unhappy villager looks to gather in his scanty rice crop, wrung with difficulty out of an unwilling soil, he invades the fields and browses

at leisure on the ripening grain, utterly scorning the feeble efforts of the hapless owner to drive him away. Probably no European has braved the deadly malaria of the country at the time of the ripening of the rice crop, or that of the drying up of the rains, but the deep and enormous foot-prints imprinted in almost every field by this jungle ravager remain visible throughout the dry season, and tell the tale of spoliation only too plainly.

Throughout this district, and indeed with most of the tribes who inhabit the wilder and more remote parts of Central India, such religion as the people possess is "devil" worship and fetishism, with just so much gloss of Hinduism as may be imparted by a rare visit to a Hindu shrine, or the presence of a brahmin whenever anything is to be got—which is seldom.

A Gond legend, taken down from the lips of one of their most celebrated bards, and translated by the author into blank verse, in imitation of Longfellow's "Song of Hiawatha," is given at length; it is interesting because it brings in here and there some curious little bits of savage life, and also from the very strong resemblance of the whole legend to that on which Longfellow's poem is based. Moreover, as the author points out, a still more curious analogy will suggest itself to the careful reader.

The whole work is written in a very lively and readable style. It will be found amusing by those fond of sporting anecdotes; and though the subjects may be thought to have an interest too local for the general reader, yet the spectacle here presented of races of men just emerging from utter barbarism, and acquiring the rudiments of civilisation, gives to the country and its inhabitants an interest which it would not otherwise possess.

M. T. SALE

OUR BOOK SHELF

Lecture Notes for Chemical Students.—Vol. II. Organic Chemistry. By E. Frankland, D.C.L., F.R.S. (London: John Van Voorst.)

In this, the second part of "Lecture Notes for Chemical Students," Dr. Frankland develops very fully his own peculiar notation. The use of thick letters, as CH_4 ; of contracted symbols for many organic radicles, as Ayo for $\text{C}_5\text{H}_9\text{O}$; of a peculiar way of writing the formulæ of well-known substances, so as at first sight to make them appear as if they were new compounds, as NPhO_2 , representing nitrobenzol; these and a few other remarkable characteristics will make this book, we should think, seem rather startling to the ordinary student. By combining attendance on lectures on organic chemistry with careful reading and a good deal of patient work, the student will find these "Lecture Notes" very useful, containing as they do, in small space, the results of the latest investigations as these bear upon the molecular constitution of organic compounds. Very large use is made of graphic formulæ, and also of the theory of types. The types used are somewhat different from those with which we are familiar in the text-books, and certainly the names applied to them are derived more from an anatomical than a chemical vocabulary; thus, the marsh gas type is termed the "Monadelphic," the methyl type the "Diadelphic," and so on. The very useful and scientific method of writing the formulæ of all organic acids, as containing the group COHO ; all alcohols, as containing CH_2HO ; and all aldehydes, as containing COH , is adopted throughout. The relations of alcohols, aldehydes, and