measure of protection can, however, it is supposed, be obtained by the use of charms provided by magicians. On one occasion, when war was being carried on with England, the magicians gave the soldiers a charm against English bullets. It was the blue flower of a species of rhododendron. "Those who carried this talisman rushed forward against columns of infantry without a shadow of fear or hesitation; and only when men began to bite the dust in all directions did the nature of the delusion break upon the army, and panic ensue."

DEAF-MUTE INSTRUCTION.[1]

THE Sundry Civil Bill grants $52,500 to the Columbia Institution for the Deaf and Dumb, an increase of $5,000 over former appropriations.

President Gallaudet says, "The object of this increase is to enable the directors to enlarge the facilities afforded in the institution for normal instruction. For many years the graduates of our collegiate department have been in demand as teachers of the deaf in the primary schools of the several States. The demand for such teachers has far outgrown our limited supply; and as no normal school for the training of teachers of the deaf exists in this country, while several are sustained in Europe, it has been thought extremely desirable that the advantages for normal instruction existing in this institution to a limited degree should be increased."

In accordance with your suggestion, I submit herewith a brief statement of my reasons for opposing this grant, and trust you will allow me a hearing before your committee: —

1. The proposed normal department is a new departure, which will probably lead to largely increased appropriations in the future, diverting public money to an object foreign to the purposes for which the institution was established.

2. Such a training-school for teachers, supported by the National Government, will interfere with that healthy competition which now exists between rival methods of instructing the deaf.

3. In the Columbia Institution a foreign language (the sign-language) is used as the medium of instruction, whereas the rival methods employ the English language alone for this purpose.

4. The graduates of the collegiate department are, of course, deaf. The institution, therefore, proposes to train deaf persons to teach the deaf. This is a backward step, detrimental to the best interests of the deaf, and subversive of the very object for which the collegiate department exists.

5. Great efforts are now made to teach deaf children to speak; and articulation teachers are employed in all important schools for the deaf, with the exception of the collegiate department of the Columbia Institution.

6. The president of the Columbia Institution has stated that lack of funds alone prevents the employment of special articulation teachers in the National College. The increased apropriation of $5,000 now asked for would, if applied to this purpose, not only enable the collegiate department to employ ordinary teachers of articulation, but also a professor of elocution, who could carry up articulation work to the highest point of perfection attainable by the deaf.

7. I would gladly support an application for $5,000, to be expended for the employment of articulation teachers and a professor of elocution in the collegiate department of the institution, but I would strongly oppose an application for the purposes set forth by President Gallaudet.

REPORT OF PROGRESS IN SPECTRUM WORK.[2]

DURING the past year or two a great deal of work has been done in the photography of the spectra of elements and the identification of the lines in the solar spectrum, which it will take a long time to work up, ready for publication: hence I have thought that a short account of what has been done up to the present time might be of interest to workers in the subject. In the prosecution of the work, financial assistance has been received from the Rumford Fund of the American Academy of Arts and Sciences, as well as from the fund given by Miss Bruce to the Harvard Astronomical Observatory for the promotion of research in astronomical physics, and the advanced state of the work is due to such assistance.

The work may be summed up under the following heads: —

1. The spectra of all known elements, with the exception of a few gaseous ones, or those too rare to be yet obtained, have been photographed in connection with the solar spectrum, from the extreme ultra-violet down to the D line, and eye-observations have been made on many to the limit of the solar spectrum.

2. A measuring-engine has been constructed with a screw to fit the above photographs, which, being taken with the concave grating, are all normal spectra and to the same scale. This engine measures wave-lengths direct, so that no multiplication is necessary, but only a slight correction to get figures correct to $\frac{1}{100}$ of a division of Angstrom.

3. A table of standard wave-lengths of the impurities in the carbons, extending to wave-length 2000, has been constructed to measure wave-lengths beyond the limits of the solar spectrum.

4. Maps of the spectra of some of the elements have been drawn on a large scale, ready for publication.

5. The greater part of the lines in the map of the solar spectrum have been identified, and the substance producing them noted.

6. The following rough arrangement of the solar elements has been constructed entirely according to my own observations, although, of course, most of them have been given by others: according to intensity, calcium, iron, hydrogen, sodium, nickel, magnesium, cobalt, silicon, aluminum, titanium, chromium, manganese, strontium, vanadium, barium, carbon, scandium, yttrium, zirconium, molybdenum, lanthanum, niobium, palladium, neodymium, copper, zinc, cadmium, cerium, glucinum, germanium, rhodium, silver, tin, lead, erbium, potassium; according to number, iron (2000 or more), nickel, titanium, manganese, chromium, cobalt, carbon (200 or more), vanadium, zirconium, cerium, calcium (75 or more), scandium, neodymium, lanthanum, yttrium, niobium, molybdenum, palladium, magnesium (20 or more), sodium (11), silicon, strontium, barium, aluminum (4), cadmium, rhodium, erbium, zinc, copper (3), silver (2), glucinum (2), germanium, tin, lead (1), potassium (1); doubtful elements, iridium, osmium, platinum, ruthenium, tantalum, thorium, tungsten, uranium; not in the solar spectrum, antimony, arsenic, bismuth, boron, nitrogen (vacuum tube), caesium, gold, indium, mercury, phosphorus, rubidium, selenium, sulphur, thallium, praeseodymium; substances not yet tried, bromine, chlorine, iodine, fluorine, oxygen, tellurium, gallium, holmium, thulium, terbium, etc.

These lists are to be accepted as preliminary only, especially the order in the first portion. However, being made with such a powerful instrument and with such care in the determination of impurities, they must still have a weight superior to most others published.

I do not know which are the new ones, but call attention to silicon, vanadium, scandium, yttrium, zirconium, glucinum, germanium, and erbium, as being possibly new.

Silicon has lines on my map at wave-lengths 3905.7, 4103.1, 5708.7, 5772.3, and 5948.7. That at 3905.7 is the largest and most certain. That at 4103.1 is also claimed by manganese.

The substances under "not in the solar spectrum" are often placed there because the elements have few strong lines or none at all in the limit of the solar spectrum when the arc spectrum, which I have used, is employed. Thus boron has only two strong lines at 2497. Again, the lines of bismuth are all compound, and so too diffuse to appear in the solar spectrum. Indeed, some good reason generally appears for their absence from the solar spectrum. Of course, this is little evidence of their absence from the sun itself.

Indeed, were the whole earth heated to the temperature of the sun, its spectrum would probably resemble that of the sun very closely.

With the high dispersion here used, the "basic lines" of Lockyer are widely broken up, and cease to exist. Indeed, it would

[1] Open letter of Alexander Graham Bell to Hon. William B. Allison, chairman of the Senate Committee on Appropriations, dated at Washington, D.C., Feb. 11, 1891.

[2] From Johns Hopkins University Circulars.

be difficult to prove any thing except accidental coincidences among the lines of the different elements. Accurate investigation generally reveals some slight difference of wave-length or a common impurity.

Furthermore, the strength of the lines in the solar spectrum is generally very nearly the same as that in the electric arc, with only a few exceptions, as, for instance, calcium. The cases mentioned by Lockyer are generally those where he mistakes groups of lines for single lines, or even mistakes the character of the line entirely. Altogether there seems to be very little evidence of the breaking-up of the elements in the sun, as far as my experiments go.

Even after comparing the solar spectrum with all known elements, there are still many important lines not accounted for. Some of these I have accounted for by silicon, and there are probably many more. Of all known substances, this is the most difficult to bring out the lines in the visible spectrum, although it has a fine ultra-violet one. Possibly iron may account for many more, and all the elements at a higher temperature might develop more. Then, again, very rare elements, like scandium, vanadium, etc., when they have a strong spectrum, may cause strong solar lines, and thus we may look for new and even rare elements to account for very many more. Indeed, I find many lines accounted for by the rare elements in gadolinite, samarskite, and fergusonite other than yttrium, erbium, scandium, praeseodymium, neodymium, lanthanum, and cerium, which I cannot identify yet, and which may be without a name. For this reason, and to discover rare elements, I intend finally to try unknown minerals, as my process gives me an easy method of detecting any new substance or analyzing minerals however many elments they may contain.

The research is much indebted to the faithful and careful work of Mr. L. E. Jewell, who has acted as my assistant for several years. Preliminary publications of results will be made in the *University Circulars*.

Among the latest results I may mention the spectroscopic separation of yttrium into three components, and the actual separation into two. HENRY A. ROWLAND.

DUTCH BORNEO.[1]

LITTLE is known of the interior of the Island of Borneo, and therefore the information supplied by Heer S. W. Tromp in the *Tijdschrift van het Kon. Nederlandsch Aardrijkskundig Genoot.*, Deel vii. No. 4, though incomplete, is very acceptable. In 1885 he steamed up the Mahakam River to Muvara-Pahu, a village about 190 miles from the sea. Near the coast the land is flat, and is being laid out in rice-fields. It would also, in Heer Tromp's opinion, be suitable for the cultivation of sugar-cane. Farther up the river, hilly country is entered, covered with a layer of yellowish-red soil, of little value for agriculture. After eight hours' steaming from Samarinda, Heer Tromp passed the mouth of the Sebulu River, and two hours and a half later reached Naga-Beulur. Here the hills, which extend from Pelarang (a short distance below Samarinda), suddenly terminate, and the river emerges through a narrow channel from a level tract, stretching northwards probably to the frontier of Berau, which was formerly the bed of a large lake. Even now this depression is not entirely filled up. Meres and morasses of large area lie on either side of the Mahakam, and when the water is high, that is, during the greater part of the year, a large proportion of the country is submerged. The district of the Upper Mahakam is inhabited by a tribe of Dyaks, known as Bahau-Dyaks in Kutei, and elsewhere as Pari-Dyaks. Their number is estimated at 4,500. Formerly they were notorious head-hunters, and were much dreaded in the Baritu valley, but of late greater security has been established by the interference of the Sultan of Kutei.

The development of the country, however, has not been accelerated thereby, for, with the festivals held on the bringing-home of heads, has also disappeared the stimulus to industry. Large sums were formerly expended in gala-dresses for the women, of silk adorned with beads; and tobacco and rice were provided in abundance. Moreover, the Buginese dealers, as they have circulated more freely through the country, have introduced hazard and cock-fighting, with the most disastrous consequences. The steamer in which Heer Tromp travelled was unable to ascend the river beyond Muvara-Pahu, but he himself advanced some distance farther in a rowing-boat. As far as Juhalang the river is easily navigable; but beyond, the current is too strong, except when the water is abnormally low, and at Kapala-kiham a series of waterfalls practically limits the navigation.

Hence the difficulty of extending Dutch rule into Upper Kutei. Indeed, communication with Sarawak along the Seliku, one of the most important affluents of the Mahakam, which rises in the Batu-Tibang opposite the sources of one of the tributaries of the Batang-Rejang, seems to be more feasible than with the Lower Mehakam. It is also possible to reach the Upper Kayan by the Boh River, which enters the Mahakam above the first fall; but it necessitates a journey of eight days on the river, and three over uneven and stony country to the highest navigable point of the Laya, a tributary of the Kayan. In the last-mentioned river an obstruction is said to exist even more formidable than the falls on the Mahakam. This remote country is inhabited by a number of Dyak tribes, which, as well as the Bahau-Dyaks of the Malakam, the Kenyas of the Upper Kayan, and others, had their home originally near the sources of Kayan. Since such insurmountable obstacles to communication exist on the routes already discussed, Heer Tromp turns his attention to the Kapuas River on the west. He passes over the lower course of the river up to Bunut with only a few cursory remarks, as it has been already described by Professor Veth in his *Borneo's Westerafdeeling*. The town of Bunut, at the mouth of a tributary of the same name, is the capital of the last Malayan kingdom.

Several affluents enter the main stream before the next town of any importance, Putus-Sibow, is reached. Here the Dyaks carry on a considerable trade with the Malay dealers, bartering the products of their forests against copper utensils, salt, tobacco, linen, crockery, etc. In 1888 Heer Tromp ascended this river, the Kapuas, in a steamer as far as the mouth of the Mendalam, a distance of 400 miles from the sea. It will be seen at once that it possesses a great advantage over the Mahakam, on which navigation is possible only for a distance of 250 miles.

Moreover, the Mendalam can be ascended by steamer, and Heer Tromp continued his journey in a boat up the Kapuas itself as far as Lunsa. Hajji Achmet, a native clerk, ascended the Bongan River, which enters the Kapuas at Lunsa, and its affluent the Bulet, to a point whence, he heard, the Seputan, a tributary of the Kaso, which flows into the Mahakam, could be reached in a day's march. This appears probable, for nowhere in this country are elevations of any great height to be seen. The Taman-Dyaks, who dwell on the Upper Kapuas, are more civilized than the Bahaus or the Kayans. Their women wear tasteful sarongs ornamented with beads and shells, and do not tattoo themselves, like the Kayan women.

[1] From the Scottish Geographical Magazine for February, 1891.

EDUCATION IN GERMANY.[1]

THE resolutions arrived at by the Conference on School Reform in Berlin may be summed up as follows: —

(1) Only two kinds of high schools are to survive, — gymnasia and non-Latin or non-classical schools (oberrealschulen and höhere bürgerschulen). A common lower school for gymnasia and non-Latin schools, so warmly advocated by many, is considered undesirable. The change from the one school to the other will be facilitated in every possible manner.

(2) The over-pressure, which is one of the most crying evils at the present time, is to be greatly reduced. A diminution of the hours devoted to Latin and Greek is considered possible, without any risk to the supremacy of classics. The Latin essay is to be abolished, as well as the Greek translation in the written examination for remove into the prima. German is to become the chief subject of instruction. Contemporary history is to be more thoroughly studied, without, however, adding to the hours assigned to history.

[1] From the London Journal of Education.