

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 appropriation 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 prosecu-

tion 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 (2), 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, praeodymium; 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.