SPECIAL CONTRIBUTIONS.

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By HERMAN W. SMITH, Librarian, Weather Bureau.

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Ames, Joseph S. Theory of physics. New York, 1897. 12mo. 513 pp. 1 plate.

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Oregon.—Pague, B. S., and Blandford, S. M. Weather forecasting and weather types on the North Pacific Slope. Published by permission of the Chief of Weather Bureau. Portland, 1897. 8vo. 29 pp.

West Virginia.—Ninth annual report of the West Virginia Agricultural Experiment Station for the year ending June 30, 1896. By John A. Myers, Director. Fairmont, 1897. 8vo. 261 pp.

THE ROENTGEN RAYS.

By Prof. JOHN TROWBRIDGE (from the Harvard Graduates Magazine for June, 1897).

The investigations in the Jefferson Physical Laboratory of Harvard University on the subject of the Roentgen rays have been directed to the more purely scientific side of the question of discharge of electricity through gases, a subject of which the Roentgen rays is only a part. The most familiar example of the discharge of electricity through gases is a stroke of lightning. This discharge develops, so to speak, a current of electricity which is similar to that by means of which we telegraph or telephone, but its duration is extremely short. In its passage it encounters a resistance *in the air* instead of *on a telegraph wire*. Moreover, it passes to and fro or oscillates, and the time it takes to make an excursion in one direction is barely a millionth of a second, while the to and fro motions on a telephone wire are nearly a thousand times slower. When the lightning discharges take place in the higher regions of the air, where the air is highly rarefied, we have instead of the zigzag white flash of lightning the red and yellow auroral streamers. All of these manifestations of the discharges of electricity can be imitated in a laboratory, and by exhausting glass tubes of almost every trace of air we at length obtain a discharge of electricity which produces the Roentgen rays.

There is no break in the continuity of the phenomena of electricity from the current by means of which we telegraph and telephone, through the various manifestations of lightning and the northern lights, up to the production of the Roentgen rays; and it may be that the corona of the sun, with its strange streamers which are only visible during an eclipse of the sun, is a manifestation of the discharge of electricity, and that the earth is one pole of a species of electrical machine and the sun the other pole, and that in our whirling through space we pass through great streamers of the corona and are conscious of electrical disturbances in the form of northern lights; and it may be that the physical and mental conditions of humanity are,influenced in ways unsuspected by the changes in our electrical condition.

When we thus consider the phenomena of the discharge of electricity through gases, we see that the manifestation of the Roentgen rays, in revealing the skeleton of the human body, is only a comparatively small phenomenon in a great subject which involves the life of the human race; for light and heat are now considered as electrical phenomena, and it is impossible to find a space on this earth which is free from electromagnetic waves, unless, indeed, we place ourselves in a hermetically sealed lead or iron chamber from which all air has been exhausted. Thus it may be said that life and electricity die together.

In order to study the energy manifested by the Roentgen rays, I have had constructed a storage battery of ten thousand cells, which I believe is the largest storage battery at present in existence. The object of such a battery is to obtain a steady source of electricity. Each cell of this battery develops a certain amount of electricity, which can be closely estimated. When the battery is exhausted it is readily recharged by a dynamo, and one can by its means exhibit all the phenomena of electricity from the Edison filament lamp, the arc light, the phenomena of magnetism, and the dis-