the bones of a hand laid upon the plate holder, and subsequent plates have revealed the bones of the hand and arm with startling distinctness. (See Plate 3, Fig. 2.)

It was possible yesterday to test the method upon a broken arm. After an exposure of 20 minutes the plate on development showed the fracture in the ulna very distinctly. Comment upon the numerous applications of the new method in the sciences and arts would be superfluous.

Edwin B. Frost.

Hanover, N. H., February 4, 1896.

EXPERIMENTS ON THE RÖNTGEN X-RAYS.

During the past week experiments have been in progress in the physical laboratory of the University of Pennsylvania on the Röntgen phenomena. The apparatus has been gradually simplified till now only a single induction coil about 12 inches long and 4½ inches in diameter is used. The resistance of the primary is about 0.3 of an ohm, and that of the secondary about 3,200 ohms. The current for the primary is supplied by eight or ten storage cells connected two in multiple arc. The Crookes tube is a pear-shaped one about 10 inches long and 4½ inches in diameter at the larger end. The exposure has been inconveniently long, an hour or more giving the best results.

Impressions of several surgical cases, including deformed fingers, fractures, etc., have been successfully produced. The results seem to be best where the tube is about 5 inches from the sensitive plate, with its longer axis vertical and the cathode at the top. A card with a broad line of white lead paint upon it was used, showing the card transparent and the paint opaque.

Special experiments made by Dr. H. C. Richards indicate that amethyst, quartz, calc spar, mica and tourmaline are quite opaque. In one of the experiments a ⅜-inch aperture in a copper screen was placed 2½ inches below the tube. The sensitive was 3½ inches below the aperture. The result showed that the rays in passing through the opening were considerably diffused. Experiments have been arranged to examine the possible deviation of the rays in passing through a wooden prism. The results as yet are not conclusive. The pictures accompanying this article (see Plate 4) are some of a number taken on February 5th and 6th. One shows a thick leather pocket purse containing a couple of coins. Upon the same plate were placed a slip of thin glass and a bit of aluminium tube. As is seen, the glass and aluminium seem equally opaque. Another of the cuts shows the outlines of a pocket pincase taken by Dr. R. R. Tatnall. Every pin shows clearly in its place. Some flowers painted upon one of the surfaces are quite visible in the negative.

In our experiments the sensitive plates have been enclosed light-tight in an ordinary plate holder and placed horizontally upon the table beneath the tube. Upon the slide of the plate holder were placed the articles to be tested.

The wide field for the development and the application of the new science will become apparent to everyone. As has already been suggested, it may prove to be an efficient mode of examination for the surgeon. It may also be used to judge the genuine from the false as in the detection of a spurious diamond or other gem from the real.

As the X-rays are not light rays, but probably are some form of radiant energy, the writer has suggested the term *radiography* instead of photography for the new process.

The comments of several scientists that the form of wave motion transmitting the energy concerned in the Röntgen phenomena is longitudinal and not transverse, have especial interest. It is shown in a recent article by G. Jaumann, in Wiede-

mann's Annalen for January, that by a small modification in Maxwell's equations to satisfy the conditions of high rarefaction, which is met with in a Crookes tube, longitudinal ether waves are possible, which would possess many of the properties of the so-called cathode rays.

ARTHUR W. GOODSPEED.

UNIVERSITY OF PENNSYLVANIA, Feb. 8.

SCIENTIFIC NOTES AND NEWS.

GENERAL.

AN admirable portrait of the astronomer Schiaparelli forms the frontispiece to *Minerva* for 1896.

DR. S. P. LANGLEY has been elected one of the Foreign Members of the Royal Society of London. There are now six from the United States, Alexander Agassiz, B. A. Gould, S. P. Langley, Simon Newcomb, H. A. Newton and H. A. Rowland.

NEW honors are being bestowed upon the discoverers of argon. First came the Barnard gold medal of Columbia College, then the $10,000 Hodgkins prize, then the prize of 50,000 francs from the French Institute and now it is announced that Lord Rayleigh and Professor Ramsay have been made Knights of the Legion of Honor, by order of the French Government.

MR. W. L. SCLATER, son of the veteran secretary of the Zoölogical Society of London, has been appointed curator of the South African Museum at Capetown. Mr. Sclater was for some time deputy superintendent of the Indian Museum at Calcutta, and has more recently been assistant master at Eton. Mr. Sclater is a well trained zoölogist. His predecessor at Capetown, Mr. Rowland Friman, was a botanist.

MR. ROBERT RIDGWAY, of the National Museum, has gone to Southern Florida to study the spring bird migrations, during February and March. His son, Audubon Ridgway, a promising young ornithologist, is his companion.

MR. FRANK HAMILTON CUSHING, of the Smithsonian Institution, is still engaged in the investigation of the ancient lake dwellings of southern Florida, where he has been since December.

THE aquarium, which was so attractive a feature in the display of the United States Fish Commission at the Atlanta Exposition, has been transferred to the custody of the Smithsonian Institution, and will be installed in the National Zoölogical Park in Washington.

THE delay of President Cleveland in appointing a Commissioner of Fisheries to succeed the late Colonel Marshall MacDonald is quite unaccountable. The requirements of the law as to the qualifications for this office are so explicit that there ought to be no difficulty in making a choice. There are few men in the country who possess 'proved scientific and practical knowledge of the fishes of the coast.' The position was created for the late Prof. Baird, who created the organization, and brought it to a high state of efficiency. It would seem a matter of necessity that his successor should be a naturalist and one who has had experience in the study of fishes and the fisheries.

THE government of Greece has granted to the American School of Archæology, at Athens, the privilege of making excavations on the site of ancient Corinth.

THE appointment of Dr. John S. Billings to be chief librarian of the consolidated libraries of New York City is a most excellent one—though it is to be regretted that his work in sanitary science should be interfered with. His admirable abilities as an administrator will have full exercise in this new position, and there can be little doubt that he will be able to organize some new advances in bibliography as well. Dr. G. E. Wise, of the Newberry Library, Chicago, in a recent article in the *Library Journal*, gives an appreciative survey of his *Index Catalogue of the Library of the Surgeon Generals Office*—the extent and importance of which is just beginning to be appreciated outside of the medical profession.

ONE of the most extensive zoölogical works of modern times will be *Das Tierreich* projected by the Zoölogical Society of Berlin, to be edited by Professor F. E. Schulze. It is to contain descriptions of all the known species of animals, prepared upon a uniform plan.

THE pictures of living walruses, in *The Cosmopolitan* for February, are from photographs