the latest, March, 1850. Vol. iii. is stated by the publishers to be in press.

Of the papers reprinted in these first two volumes, only two of the more important are of a purely mathematical character, and these treat of the properties and methods of computation of infinite periodic series such as arise in many physical problems, which series were first systematically employed and explained by Fourier in 1822. Fourier's treatise [1] is to-day the best introduction to a knowledge of this kind of analysis, besides being one of the most brilliant expositions, in any branch of science, in existence. With the exception of a single paper of 42 pages, upon a differential equation relating to the breaking of railway bridges under loads moving at high speeds, the remaining papers all come under the head of fluid motion in one way or another, and include extensive discussions of the fundamental dynamical equations of motion of perfect fluids, of viscous fluids, and of elastic solids. These discussions treat, among other subjects, the theory of oscillatory waves, the equilibrium of the earth in a fluid state, the variation of the force of gravity on its surface, and the undulatory theory of light.

The work of Professor Stokes in hydrodynamics is of special importance in correcting and rediscussing the results obtained by Lagrange and Poisson, and in paving the way for the more modern developments of Helmholtz and Thomson in vortex motion, and of Maxwell in electricity and magnetism.

[1] Analytical theory of heat. By JOSEPH FOURIER. Translated, with notes, by Alexander Freeman. Cambridge, 1878.

But the papers of Stokes which are probably of most interest to the mathematical physicist of to-day are those upon the undulatory theory of light, in which he has added essentially to our knowledge of the constitution of the luminiferous ether by showing how the phenomena of aberration may remain unaffected by the fixity or motion of the ether, as also by his investigation of the theory of diffraction, by which he has sought to decide whether the vibratory motion of a plane polarized ray lies in the plane of polarization or at right angles to it.

By these investigations, and by others, among which may be noticed that of the colored rings of Newton, he has explained difficulties in Fresnel's undulatory theory, and essentially improved it.

The treatise of Verdet,[1] which is the most complete and important exposition of the undulatory theory yet written, gives a complete bibliography of this subject, extending to many hundred titles, from which the reader can correctly estimate the labors of Professor Stokes in this field.

The lifelong labors of Professor Stokes have given an immense impulse to mathematico-physical research in England; and the republication of these papers by the syndics of the Cambridge university press is a graceful and well-deserved tribute to the Nestor of the greatest mathematical school in the world.

[1] Leçons d'optique physique par E. Verdet. Paris, tome. i., 1869; tome ii., 1872. The following translation and revision to date is in process of publication: Vorlesungen über die wellentheorie des lichtes, von E. Verdet. Herausg. von Dr. Karl Exner, Braunschweig. Bd. i. 1881.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Geologic work in the South Atlantic district. — Owing to the as yet incomplete state of the topographic work in the southern Appalachians, the systematic geologic survey of that section has not yet been commenced. However, several geologic reconnaissances have been made, and considerable collections of paleontologic material have been sent into the main office of the survey. During the season of 1883 Prof. H. R. Geiger examined the geologic structure of a considerable portion of Virginia and West Virginia. During the latter part of July he was in the eastern part of Virginia, but in August transferred his field of work to Greenbrier county, W. Va., where he studied the formations that are exposed between the Greenbrier River and the Lewis Tunnel, just east of Alleghany station, W. Va. A collection of Devonian fossils was made. In September his work was carried into Alleghany county, Va., where a careful examination was made of the rocks so well shown there. The thickness, dip, etc., of the beds were obtained, and an excellent series of typical specimens secured. In October the field was extended northward to Rockingham county, but bad weather impeded the operations. Through November a special study was made of the foldings in the limestones that lie between the Blue Ridge and North Mountain, and a careful comparative examination made of the limestones of Rockingham and Rockbridge counties, Va.

Professor Ira Sayles was assigned to the northeastern part of Tennessee, and adjacent portions of Virginia and Kentucky. The early part of July was spent by him in the examination of the caves near

Clinch River in Virginia. He next examined the coal-beds on Big Yellow Creek in Bell county, Ky., and the Dyestone iron-ore beds a few miles farther down Poor valley. The following month the work on Clinch River was continued in Hancock county, Tenn., especially with the object of ascertaining and more accurately defining the extent and direction of the faulting so well displayed in that section. The upper coal-measures were also examined, and a running field-chart of the county made. In the latter part of the month, Professor Sayles discovered some very interesting cave-deposits in a quarry in Hawkins county, Tenn. The formations of this county were carefully studied during September and October, and large collections of fossils obtained. The latter part of October found Professor Sayles at Knoxville, in accordance with his orders, to examine the vicinity of Knoxville and Centreville for Potsdam fossils to supplement Mr. Walcott's paleontologic work. He was engaged in this region through November and December.

Topographic work in eastern Tennessee. — With a view to facilitate future geologic work, the division for the topographic survey of the southern Appalachian region was organized upon a considerably enlarged scale for the season of 1883. As already noted in *Science*, five topographic and two triangulation parties were put in this field.

Topographic party No. 3, in charge of Mr. Frank M. Pearson, was assigned to the valley of East Tennessee. The territory covered by his party includes about five thousand square miles, lying between parallels 36° and 36° 35′, and between meridians 82° 15′ and 84° 30′. This area is the northern half of the valley of East Tennessee; extending from the summit of the Cumberland Mountains and Cumberland plateau, on the north and west, to the summit of the Smoky Mountains, or state line between North Carolina and Tennessee, on the south and east. The topographical character of this region is such that the methods of work employed in the west had to be somewhat modified. It was necessary to carry on a considerable part of the work by means of compass meander-lines; and the rapidity of this class of work, and of the triangulation, was seriously interfered with on account of the dense timber which prevails everywhere, and by the atmospheric conditions, which are rarely favorable for clear views of any great extent. The prominent topographical features are peculiar. Almost the entire main valley is occupied by parallel ridges, that have their origin in south-western Virginia, and run in a south-westerly direction through Tennessee, and into Alabama and Georgia. In this, of course, the drainage system is simple, the larger streams, with few exceptions, being confined by the ridges which enclose their head waters.

The Bays Mountain, consisting of a great number of these parallel ridges, or mountains, as they are wrongly called, constitutes the divide between the Holston River on the west, and the Nolachucky and French Broad Rivers on the east. In the vicinity of this mountain, and on either side, the drainage is almost entirely underground, the water flowing through and in the limestone strata that underlie this region. This renders the tracing of the streams a difficult matter. The minor drainage collects in numerous sink-holes, which occur on the broad divides from which the streams flow in underground channels, and come to the surface again in unexpected places, and frequently at considerable distance from the point of disappearance. A striking example of this kind of drainage is seen in Mossy Creek, which is also interesting from the luxuriant growth of confervoids and moss with which its bed is covered. This stream rises on the north slope of Bays Mountain, and, after a course of three miles, disappears, and is not seen as a surface-stream for a distance of seven miles, when it re-appears, and flows for three miles to its junction with the Holston River. Five miles from the source of the stream there is a so-called sink-hole, which is six hundred feet in length and of unknown depth. A ninety-foot pole does not touch the bottom. This is really a surface appearance of the stream. A saw-mill was located on the creek a short distance above the first point of disappearance; and the people of the country have frequently noticed that slabs and saw-dust from the mill would rise to the surface in this sink-hole, then disappear, and come to the surface again in Mossy Creek, three miles above its mouth, where it rises for the last time.

Mr. Pearson says that the topographical unity of the ridges and valleys is not recognized by the inhabitants of the country, and hence some confusion has arisen. To the same ridge or valley, often only fifteen or twenty miles in length, as many as five different names are frequently applied; the universal custom being to re-name a ridge or valley whenever it is cut in two or crossed by a stream. This confusion of names also arises partly from the fact that no thorough or connected survey of the region has ever been made, although it is one of the earliest settled portions of the United States.

The natural water-power facilities of the Appalachian region have recently been the subject of much notice, and in this respect the valley of East Tennessee is unexcelled. There are in it many streams of considerable length, affording abundant water-power, that are not indicated on even the best existing maps of the region. Other additions and corrections of considerable importance have been determined by the work of Mr. Pearson.

PUBLIC AND PRIVATE INSTITUTIONS.

Museum of comparative zoölogy.

Arrangement of exhibition-rooms. — The exhibition-rooms are comparatively small, each one devoted to a special subject, but so combined, that, when taken together, they illustrate the animal kingdom as a whole, in its general relations and in its geographical and paleontological range and distribution. They are intended not only to meet the wants of the public at large, and of beginners as well as of more advanced university students, but also to promote research by giving assistance to specialists and original investigators. Meanwhile the work of the mu-

seum proper should be in charge of assistants whose duties are so arranged as to leave a good part of their time free for original research; the museum as a whole forming an important branch of the natural-history department of the university, with which its assistants and professors are intimately connected.

An enumeration of the contents and uses to which the space is devoted will give a better idea of the aims of the museum than a lengthy description.

Exhibition-rooms.

Synoptic room: synopsis of the animal kingdom, living and fossil.

Five systematic rooms for the systematic collections of mammalia, birds, fishes, mollusca, radiates, and protozoa; and their galleries for reptiles, insects, and crustacea.

Seven faunal rooms and galleries: North American, South American, African (including Madagascar), Indian, Australian, Europeo-Siberian,[1] Atlantic,[1] Pacific.[1]

Four rooms for the paleontological collections.

Two rooms for the paleozoic, one for the mesozoic, and one for the tertiary, as follows: Silurian and Devonian,[1] carboniferous and Jura,[1] cretaceous,[1] tertiary.[1]

The work-rooms for the assistants of the museum, and the storage-rooms, which are also intended as work-rooms of their special subjects, are distributed as follows, in addition to a large receiving-room and a general workshop: —

The alcoholic collections stored in the basement occupy four rooms devoted to fishes, two rooms for fishes and reptiles, one room for birds and mammals, one room for mollusca, one room for crustacea, one room for the other invertebrates.

The entomological department is to occupy eventually four gallery-rooms of the first story.

The work rooms and storage-rooms of the fifth story are filled by collections occupying five rooms devoted to birds and mammals, three for skins and eggs and two for skeletons, one for crustacea, one for mollusca, one for fish and reptile skeletons, one for the collection of dry invertebrates (corals, echinoderms, sponges, etc.), two for fossil vertebrates (exclusive of fishes).

[1] Not yet open to the public.

The remaining paleontological collections are crowded into four work and storage rooms. There are two work-rooms for the geological and lithological department. Four rooms are devoted to the library of the museum, and one room for the office of the curator. There are also a large general lecture-room, three laboratories for students in biology, three laboratories for students in geology and paleontology, with two smaller private rooms for the instructors. With the biological laboratories will be connected also a large room for an aquarium for both fresh-water and marine animals, and another room for a vivarium, both of which are in the basement of the building.

This will give, in all, seventeen rooms devoted to the exhibition of collections for the public; ten work and storage rooms in the basement, for the alcoholic collections; thirteen work and storage rooms for the dry zoölogical collections; eight similar rooms for the paleontological and geological collections; and thirteen rooms devoted to the laboratories, lecture-rooms, and library connected with the instruction given at the museum; the arrangement being such, that, whenever any departments (as, for instance, the geological and geographical, or the anatomical, or any other) outgrow their present quarters, room can be made for them by extensions of the building, for a long time to come, without interfering with the plans which have been carried out thus far.

In adopting a small unit for the size of the rooms (30×40 feet), all attempts at exhibition-rooms, imposing from their size, were deliberately abandoned. It is aimed only to place before the public such portions of the collections as shall become instructive; and in the storage and work rooms the appliances for storage aim at economy of space, and are intended, while they do not neglect the careful preservation of the collections, to give to the assistants and students the freest and quickest possible access to them.

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Cambridge entomological club.

Feb. 8. — Mr. G. Dimmock called attention to some curious habits of the common European earwig, Forficula auricularia, a specimen of which he had kept in confinement several months. These insects are omnivorous, but apparently prefer insects as food, eating their own species greedily. Although to all appearances blind, except to the presence or absence of light, the specimen above mentioned captured fleas (Pulex irritans) with ease in an enclosure about five centimetres in diameter. No notice was taken of a flea put in the enclosure until the flea actually touched the earwig, when the latter would rush after the flea, palpitating with the antennae rapidly, and thus keeping on his track. If the flea escaped from beneath the antennae of the earwig, the latter would find him again in a moment, and the amusing chase would be renewed, to end in the sure seizure of the flea in the mouth-parts of the earwig. The earwig was a glutton, and would often eat a large number of fleas or other insects in succession, at the end of his repast his abdomen being much distended. —— Mr. S. H. Scudder exhibited a specimen and drawings of an arachnid from the coal-measures of Arkansas. Two years ago Karsch figured a similar form from the coal of Prussian Silesia, under the generic name Anthracomartus, and Kušta has just described another from carbo-