tinued his scientific work whenever opportunity was offered. But this work was largely of a character different from that of his earlier years. Many of his papers in the first part show that his nature was too large to permit of his assuming, as some men of science have assumed, and even boastfully, an absolute indifference as to the so-called practical applications of his investigations, and their worth as a means of bettering the condition of mankind. His work while director of the Smithsonian was very closely related to applied science. He was now called upon to consider and decide questions of great practical importance. Much of his time, which he would doubtless have gladly given to researches of a higher order, was occupied in devising methods of testing materials for public buildings, in considering the acoustics of public halls, in investigating the relative value of illuminants for the light-house board; and in the capacity of chairman of this board he planned and executed the extensive and important series of experiments and investigations on the use of fog-horns, steam-whistles, etc., and on the transmission of sound, which are printed at length in the latter part of the first volume. A large part of the second volume is devoted to an extended series of essays on meteorology. This was a subject in which Henry had always been interested. On the organization of the Smithsonian institute, he had named meteorology as one of the subjects the investigation of which could properly be assumed by the new establishment. As early as 1848 he suggested the use of the telegraph in the study of American storms, and explained the benefit which would accrue to commerce and agriculture from its use in the dissemination of weather-warnings. He organized a gigantic system of voluntary meteorological observers, by the aid of which much light was thrown upon the climatic conditions of the country. All of the meteorological work of the institute was finally turned over to the U. S. signal service upon its organization, and the success of this service was and is largely due to Henry's labors as a pioneer.

His essays on meteorology were in plain and unpretentious language; the medium of their publication was such as to secure their wide distribution and diffusion among the masses of the people; and the general interest in the subject today, as well as the general intelligence of the public in regard to it, must be largely attributed to their influence. These essays constituted the first easily accessible scientific treatment of the physics of atmospheric phenomena which appeared in this country, and they contain much matter of great value to the meteorologist of the present time.

The reader will thank the editors for including in this collection several essays and addresses to scientific societies concerning their organization and working-plans, which, although not strictly scientific, have had, and will continue to have, an important bearing upon the progress of science. In every respect the work of compilation seems to have been done with exactness and care; most readers, however, would have welcomed the addition of a good portrait and a brief biography.

The publication and circulation of these volumes will enable scientific men, both at home and abroad, to make a juster estimate of Henry's great services to science, and the study of his earlier researches must convince competent judges that he was one of the really strong physicists of the first half of the present century.

STORER'S AGRICULTURE.

UNDER the modest title of 'Agriculture in some of its relations with chemistry,' Professor Storer has given us what, in our judgment, is the most noteworthy contribution to agricultural literature of recent years, either in this or any other country. We say this advisedly, and after a careful examination of the book.

It may be said to treat broadly of manures and fertilizers, or better, perhaps, of 'plant-feeding,' since it includes, along with the main topic of manures and manurial substances and their application, much with regard to the plant itself; the soil and atmosphere, which are the media of its growth, and from which its food is derived; the culture and handling of different crops; and the adaptation of crops and systems of farming to local conditions.

The subject is a difficult one to treat satisfactorily, on account of its complexity and also because of the very imperfect state of our knowledge upon it in many directions, and accordingly there has been a dearth of good books upon it. As regards the English language, the dearth may be said to have been absolute. There has been hitherto no book treating of these matters which could be recommended to a student who desired any thing remotely approaching a thorough and systematic acquaintance with the present state of our knowledge on this subject.

The students of other countries have been somewhat better off; but even there, so far as the writer's acquaintance with the literature of agriculture extends, there has been no one work which adequately covered the whole field of plant-feeding in its scientific and practical aspects. This

Agriculture in some of its relations with chemistry. By F. H. STORER. New York, Scribner. 8°.

we think Professor Storer's book does. While, in the words of the preface, 'it makes no special appeal to chemists or students of chemistry,' it is nevertheless a thoroughly scientific book in the truest sense of the term. While it is strikingly free from the technicalities of science, its statements and discussions are based on so thorough a knowledge of science in its relations to agriculture, and so pervaded by the scientific spirit, as to render the book most valuable to all students of agricultural science.

It is, however, in its felicitous union of science with practice that the book is pre-eminent. Many otherwise good agricultural books suffer from a certain impracticability, arising from a deficient acquaintance, on the part of their writers, with the conditions of practice; while of others exactly the converse is true. Neither of these faults, however, can be attributed to the present work. While its scientific merits commend it to the student of science, its practical common sense as well as the lucidity and suggestiveness of its discussions will commend it no less to the thinking farmer. Indeed, we anticipate that one of the most valuable features of the book will prove to be that it will, on the one hand, help to remove the prejudice against science which is still too prevalent among farmers, and, on the other hand, tend to inspire in the minds of students of science a greater respect for, and a more earnest study of, the practices and maxims of successful practical agriculture.

GEOLOGY OF MINNESOTA.

THE annual reports of state surveys are, for the most part, dull reading, especially for non-residents; since they are necessarily of a detailed and fragmentary character, showing the progress of investigation in many different directions, with very little completed work. Both the reports before us, however, embody material of more than local interest, and it is desired to call attention here to those portions, without attempting to notice the entire contents of the volumes.

The notes on the section from Duluth north to the iron-mines about Vermilion Lake give Professor Winchell's latest views concerning the stratigraphy of the crystalline rocks of north-eastern Minnesota, between Lake Superior and the international boundary. The height of land between Lakes Superior and Vermilion is marked by two distinct ranges, — the high and broad Mesabi Range, composed of eruptive gabbro and red metamorphic granite; and, north of this, the lower and narrower Giant's Range, consisting of gray and red syenites, which have been referred to the Laurentian, and mark an important anticlinal axis. North of this axis, and dipping north at high angles, is a broad belt of the green and red jaspery and magnesian schists and conglomerates referred to the Huronian. South of the axis, the Huronian series appears to be concealed by a fault; but we have above it, dipping to the south in conformable succession, the Animikie slates and quartzites, the gabbro and granite of the Mesabi Range, and the greenish trap of the cupriferous series, extending from the Mesabi Range to Lake Superior.

The gabbro, Animikie, and Huronian series are each characterized by important deposits of iron ore; and this district is, with almost phenomenal rapidity, assuming a position of the first importance as regards the products of its mines. The iron of the gabbro belt is, as usually with rocks of that class, titanic. It furnishes the iron-sand of the Lake Superior beach, and, so far as known, has no parallel in Michigan and Wisconsin. The iron ore of the Animikie slates is hard hematite and magnetite, and probably parallel to the Commonwealth mines of Wisconsin, but without any known equivalent in Michigan; while the Huronian deposits, occurring chiefly about the south end of Lake Vermilion, consist almost wholly of hematite, and seem to agree closely in character and position with the Marquette and Menominee deposits of Michigan and Wisconsin.

The Vermilion Lake mines are being rapidly exploited, and the discovery of these ore-bodies is regarded as marking an epoch in the economic history of Minnesota and the north-west.

The salt-wells of north-western Minnesota and the adjacent portions of Dakota and Manitoba are believed to give promise of important developments; and various facts are cited tending to show, that, although the occurrence of carboniferous strata in this region has not been heretofore definitely known, these brines, like those of Michigan, really have their source in that formation.

Minnesota, it is well known, is, for the most part, deeply drift-covered, and the solid rocks are rarely exposed, except along the principal streams. For this reason, great geological interest attaches to the numerous deep wells which are being drilled in different parts of the state. They not only show what would be the surface rock if the drift were removed, but also establish the order, thickness, and continuity of the different horizons down to the crystalline foundations of the state, at points far removed from their outcrops.

In the deep wells of central and south-eastern

Thirteenth and fourteenth annual reports of the geological and natural history survey of Minnesota, for the years 1884 *and* 1885. By N. H. WINCHELL. St. Paul, State. 8°.