

ject of study to the physicist, as its unity is a merely subjective one; and the geographer, in treating these subjects, approaches the domain of art, as the results of his study principally affect the feeling, and therefore must be described in an artistic way in order to satisfy the feeling in which it originated.

Our consideration leads us to the conclusion that geography is part of cosmography, and has its source in the affective impulse, in the desire to understand the phenomena and history of a country or of the whole earth, the home of mankind. It depends upon the inclination of the scientist towards physical or cosmographical method, whether he studies the history of the whole earth, or whether he prefers to learn that of a single country. From our point of view, the discussion whether geology or meteorology belongs to geography is of little importance, and we are willing to call all scientists geographers who study the phenomena of the earth's surface. We give geology no preference over the other branches of science, as many modern scientists are inclined to do. The study of the earth's surface implies geological researches as well as meteorological, ethnological, and others, as none of them cover the scope of geography, to delineate the picture of the earth's surface.

Many are the sciences that must help to reach this end; many are the studies and researches that must be pursued to add new figures to the incomplete picture; but every step that brings us nearer the end gives ampler satisfaction to the impulse which induces us to devote our time and work to this study, gratifying the love for the country we inhabit, and the nature that surrounds us.

FRANZ BOAS.

ITALIAN MEDICAL PSYCHOLOGY.

THE study of the nervous system in health and disease has been assiduously cultivated in Italy for many years. The peculiar environment and volatile characteristics of the race may have been influential in drawing attention to the study of insanity.

Italian alienists have taken a deep interest in the psychological aspects of their specialty; and their main review, the *Rivista sperimentale di freniatria*, has been thriving for many years. A brief notice of a few of the articles contained in the last volume will serve to indicate some of the directions in which work is being carried on.

A frequent contributor to this review was the physiologist Buccola, who died last year. He has published a volume in the International scientific series which is devoted to an account of the ex-

perimental study of the time of psychic processes, and which merits an English translation. One of his latest researches is embodied in a long article in this review on the electric reaction of the acoustic nerve in the insane. If you place one of the poles in the external auditory chamber, and the other on the neck or the hand, besides causing slight pain, muscular contractions, etc., a distinct sound will be heard on closing the circuit if the negative pole is in contact with the ear, and on opening the circuit if it is the positive pole. This for the healthy ear. But in the insane this formula is sometimes reversed, and suffers irregularities. The examination of the auditory apparatus is thus of diagnostic value, especially in cases of auditory hallucinations. In almost all such cases the hearing is thus shown to be diseased, and in a few cases stimulation of the auditory nerve caused the hallucinations to appear.

Two observers, Tambroni and Algeri, contribute to this study of the psychic diagnosis of insanity an account of experiments upon the reaction times of the insane. After some preliminary training, the patient was subjected to eight tests of forty observations each. An observation consisted, 1°, in measuring the time necessary for the patient to feel the contact of a point; 2°, the time to perceive whether a single point or a pair of points 2.2mm. apart was drawn across the tip of his right forefinger. The paranoic patient reacts more quickly than the normal man; and in this is implied not only that he feels sooner, but knows what he feels more rapidly: it is a psychic hyperaesthesia. In all other forms of insanity the time of a simple reaction and of a distinction is lengthened when the normal time is .183 of a second; the time of the paranoic type is .174 of a second; of the maniacal, .312; of the demented, .344; of the epileptic, .362; of the melancholic (in whom all mental life is sluggish and monotonous), .374. Four persons of each type were examined. It takes slightly longer to perceive a double than a single point.

A very careful study on the effect of repetition of simple acts, that is, of practice, upon the time it takes to perform them, is rendered by Guicciardi and Cionini. They take as their basis three well-known laws regarding practice; viz., 1°, that it makes repetition easier (and quicker); 2°, that it does so at first more rapidly than later on; and, 3°, that a limit to this process is slowly reached. The original part of their work consists in showing that practice has greater abbreviating power in complicated than in simple acts. A simple touch reaction by the effect of 250 repetitions was shortened .018 of a second; the time for perceiving that but a single point was touching

the skin, by .121 of a second; that two points were touching, by .194 of a second. The time necessary for uniting three letters was shortened by 1.956 seconds in 500 repetitions. In associating abstract words, there was a difference of nearly five seconds between the longest and the shortest time.¹

MINERAL PHYSIOLOGY AND PHYSIOGRAPHY.

THIS book is a collection of essays which their author has published during the past few years in the proceedings of several learned societies, especially in the Transactions of the Royal Society of Canada. The preface states that they were all written with a predetermined plan, which their presentation in this connected form for the first time fully realizes. The work will furnish a valuable addition to every geological library. There is apparent in it an astonishing amount of learning and painstaking research, in spite of the fact that the views of others are not infrequently presented in a partial or one-sided manner; the author's conclusions also are well worthy of study, although many of them will hardly be received by geologists as final.

It would be impossible, in a brief review, to do justice to a single one of the essays, to say nothing of the collection of them before us. The first two serve as a general introduction and attempt to show the relations of the natural sciences to each other and to geology. Then are considered in succession the chemistry of the earth's atmosphere; the origin and decay of the crystalline rocks; a natural system in mineralogy; a history of pre-Cambrian rocks and serpentines; and, finally, the Taconic question.

The most interesting and novel portion of the work is contained in chapters v. and vi., which set forth the author's remarkable views regarding the origin of the crystalline schists. These, as he states, are purely Neptunic or Wernerian. The former hypotheses relating to the Archean rocks are reviewed and classified as, 1°, endoplutonic; 2°, exoplutonic; 3°, metamorphic; 4°, metasomatic; 5°, chaotic; 6°, thermochaotic. None of these are regarded as satisfactory; and a seventh, so-called 'crenitic' theory is therefore advanced. According to this, the globe has solidified regularly from its centre outward, its last layer being a basic, quartzless rock, not unlike dolerite in composition. This mass was fissured and ren-

dered porous by 'refrigeration and crystallization' (!) and upon it were precipitated the waters, till then held in the atmosphere. These were set in circulation by the heat from below, and under high temperature and pressure they leached out the more acid, alkaline silicates from the basic substratum below, and deposited them in thick layers at the surface, like the products of thermal springs (hence the term 'crenitic,' from κρήνη, 'a fountain'). The chemistry of this process is supposed to resemble that whereby quartz, orthoclase, and the zeolitic minerals are occasionally deposited in cavities of basic eruptive rocks. By such crenitic action, in the author's opinion, all the banded, pre-Cambrian rocks were formed. These were, moreover, of such a thickness as to bury the original basic substratum too deeply for any subsequent upheavals to expose it at the earth's surface. The crenitic hypothesis is also supposed to offer "for the first time a reasonable and tenable explanation of the universal corrugation of the oldest crystalline strata," in the removal of such a large quantity of matter from the underlying basic layer. Through these crumpled crenitic rocks (Archean granites, gneisses, and schists) came intrusions of a basic magma derived from the underlying or original stratum, while the upper or transition pre-Cambrian rocks, as the author calls them with Werner, are regarded as derived from the subaerial decay of the two types of primary origin.

The objections which at once suggest themselves to this remarkable theory of the origin of the crystalline rocks are far too many to be even mentioned here. The leaching-out of a layer, 'at least many miles in thickness,' of quartz and potash-felspar, from a basic substratum, requires sufficient draughts on the imagination; while, even in case this be assumed as possible, it is still more difficult to conceive how the waters could circulate through this compact overlying layer which they were depositing, with sufficient freedom to increase it to anywhere near the thickness which the hypothesis requires.

No one will deny that any single one of the numerous theories hitherto proposed, fails to satisfactorily account for all the phenomena exhibited by the so-called crystalline rocks; nor is it at all probable that any theory ever will accomplish this. There is doubtless some element of truth in all the theories, and the only way to explain the diversity of Archean geology would seem to be by the assumption of an equal diversity in the causes which produced it. The dogma that many different agencies may not have acted at the same time in the formation of the pre-Cambrian rocks, is as dangerous as the other, that the same agency may

¹ It is not quite clear whether these differences refer to the extreme limits of a single experiment, or to the extreme differences of the average of each set of fifty observations.

Mineral physiology and physiography. By T. STERRY HUNT. Boston, Cassino. 8°.