

are no less profound and significant than the changes which the physical sciences have brought about in the conditions of human life.

The change which is taking place in the philosophy of the exact sciences is many sided, but a prominent feature of it is the passing away of an old point of view, namely, that nature is exact and unvarying, that the so-called laws of the physical sciences are ultimate realities, and that great simple facts of the physical universe are revealed in their perfection, one after another, to the divining spirit of mankind. It is not easy, however, to characterize the point of view which is now becoming dominant. In one way it may be described as a reenthronement of sense, and it may be exemplified by contrasting what is said above with the point of view of the author of one of our best modern engineering treatises on hydraulics as indicated by the following extract: "Galileo said in 1630 that the laws *controlling* the motion of the planets in their celestial orbits were better understood than those *governing* the motion of water on the surface of the earth. This is true to-day, for *the theory of the flow of water in pipes and channels has not yet been perfected.*" [Italics ours.] No! and it never will be Perfected! It would take too long to explain here just what is meant by this declaration, for, indeed, it has nothing to do with the fool idea, if, indeed, it can be called an idea, that "the finite can not comprehend the infinite" so that "we may not presume to point out all the ways in which a God of unbounded resources might govern the universe." From such inanity may the great God of little things deliver us!

Every student should realize two things in connection with his study of the physical sciences. The first is that the study of the physical sciences is exacting beyond all compromise, and the second is that the completest science stands abashed before the infinitely complicated array of phenomena of the material world except only in the assurance which its method gives.²

The new physics! Let no one imagine that what he calls results (which are in nearly every case, and especially in the popular mind, a more or less shameless projection of ideas into objectivity) constitute the new physics. The readiness with which the physicist can

nowadays meet a new group of observable effects with adequate instrumental and theoretical tools is strikingly exemplified by the recent work in radioactivity. This facility of the modern scientific method in the realm of the physical sciences is the new physics, it is a realization of what Bacon long ago listed as one of the deficiencies of knowledge, namely, the Art of Inventing Arts, and the very essence of it is an increased realization of the fact that ideas are not things. Boundaries are no longer confused.

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SCIENTIFIC JOURNALS AND ARTICLES

IN *The American Naturalist* for November Thos. H. Montgomery gives the results of "Further Studies on the Activities of Araneids," dealing with questions of the snares, senses of touch and sight, and the average duration of life. To some it will seem a pity that the term *Araneids* was not used, since this termination has been much used by zoologists. Floyd E. Chidester has "Notes on the Daily Life and Food of *Cambarus bartonius bartoni*," and Austin H. Clark describes "Some Points in the Ecology of Recent Crinoids," noting some of the factors that influence their size and distribution. Shorter articles are "Evolution Without Isolation" and "A Note on the [Spawning] of the Silverside." The book reviews are unusually full and important, especially those on "The Origin of a Land Flora" and "The Animal Mind."

The American Museum Journal for December contains an illustrated article on the "Exhibit Illustrating the Evolution of the Horse" in which it is noted that the American Museum collections of fossil horses are larger than those of all other museums put together. The "Department of Mineralogy" records the reception of what is probably the largest mass of polybasite ever taken from a mine. It is announced that the "Tuberculosis Exhibit" installed in the new wing on Columbus Avenue, will remain open for several weeks.

²Taken from a paper on "The Study of Science by Young People," *New York State Education Department Bulletin*, No. 431, pp. 65-94, September, 1908.

The Museum News of the Brooklyn Institute notices the installation of an exhibit illustrating Mr. Abbott H. Thayer's principles of obliterative shading, of a group of timber wolves and of a large painting showing the appearance of a coral reef. The main article in the Children's Museum section describes coffee culture in Guatemala.

SPECIAL ARTICLES

THE DETERMINATION OF THE CLAY CONTENT OF SOILS¹

IN the method of mechanical analysis of soils originally devised and used in the Bureau of Soils of the United States Department of Agriculture,² the amount of clay was determined—after the coarser particles had been separated by centrifuging—by evaporating the clay-water to small bulk in enameled-ware sauce pans, transferring it to platinum, carrying completely to dryness, and weighing the residue. This method was found undesirable on account of the excessive time required for the evaporation, because many dust particles and fragments cracked from the lining of the sauce pans got into the clay and were weighed with it, and because the transfer from sauce pans to platinum required much time and trouble and offered possibilities of loss. To avoid these difficulties, and especially to increase the rapidity of the work, it was therefore decided to abandon the final transfer to platinum, and to complete the evaporation in the enameled-ware dishes and weigh the clay in them without transfer. For convenience in weighing and to decrease the likelihood of entry of dust, the enameled-ware sauce pans were discarded and there were adopted instead much smaller enameled-ware cups, having a capacity of about 300 c.c. and weighing about 180 grams. This method has the disadvantage of requiring a much heavier balance, but the determinations seem none the less accurate, and a great saving of time has been effected.

It is now thought that the method may be

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²See Bulletin No. 24, Bureau of Soils, U. S. Department of Agriculture (1904).

still further shortened in the case of routine analyses by abandoning altogether the direct determination of clay and obtaining its percentage by difference. The error thus introduced will probably be far less than that involved in the centrifugal (or other) separation of the clay from the silt, and both errors are almost certainly within the limits of variation which may be expected between different samples of the same soil. In one hundred consecutive analyses taken at random from the recent files of the Bureau of Soils the variations between the percentage of clay as directly determined and that found by difference ranged between 0 and 2.28 per cent. In two cases the variation was over 2.00 per cent.; in three cases, between 2.00 per cent. and 1.50 per cent.; and in six cases between 1.50 per cent. and 1.00 per cent. In all other cases the variations were 1.00 per cent. or less.

It is indeed not improbable that in many cases the determination by difference is the more accurate, as all errors due to access of dust or to loss of clay water are thus avoided. Errors due to a not impossible change in the state of hydration of the clay are also eliminated. It is believed that in the vast majority of cases the difference method in clay determination will be accurate within 1.00 per cent., and no greater accuracy is necessary or even desirable for purposes of soil classification. The saving in time is at least 30 per cent., and is believed to be well worth while in routine laboratories making a large number of analyses. The direct determination must, of course, be retained for cases of especial importance, or where a check is necessary and is probably also advisable for students' use, and for use in small laboratories.

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NOTES ON THE ATROPHY OF THE EYE OF *RAJA* *ERINACEA*

IN the skate, *Raja erinacea*, a clearly defined case of complete atrophy of the left eyeball was observed in our course this fall.

The brownish integument continued without