REPORTS

THE SMITHSONIAN INSTITUTION

NEARLY a million specimens were added to the scientific collections administered by the Smithsonian Institution during the fiscal year ending July 1, according to the report made by Secretary C. G. Abbot to the Board of Regents at their annual meeting on December 13.

From Alaska, the Dominican Republic, the American southwest and elsewhere came objects made by prehistoric man; from the Philippines came the C. F. Baker collection of East Indian insects, one of the finest in existence; from Honduras, Formosa and Sumatra came plant specimens; from Siam and China, valuable natural history collections; from Mexico and elsewhere, rare and important minerals.

These large additions to the scientific resources of the institution in one year serve to emphasize the major point made by Dr. Abbot in his report, namely, that the Smithsonian is first of all a research institution, and that one of its first responsibilities is to study these collections and give to the world the knowledge gained from them. He points out that what visitors see in the National Museum where these collections are housed is but a fraction of its wealth. The study collections include millions of specimens never put on exhibition, but which provide the basic material for studying the fauna, flora, geology, paleontology and ethnology of our country and other areas of the earth. Extensive researches of scientific value, and not infrequently of immediate utility, are constantly being based on this material.

Therefore, while recognizing the importance of the Smithsonian and its branches as centers of interest to visitors, Dr. Abbot defines the principal activities of the institution as the collection of new specimens before the constantly changing face of the earth renders this impossible; the study of existing national collections; the promotion of researches growing out of expert knowledge of the Smithsonian, for example, in the field of radiation; the publication of knowledge in both technical and popular forms, and the wide diffusion of knowledge through exchanges and correspondence. "Only one thing is lacking to promote these objects," said Dr. Abbot. "We have the equipment, the experts, but we lack the means."

In pursuance of these purposes during the last year the Smithsonian and its branches sent out 30 expeditions relating to the natural history sciences, working in fields as far apart as Alaska, Mexico, South America, South Africa, China and the East Indies. Special attention was paid to the West Indian archipelago where zoological, paleontological and archeological expeditions were sent by the National Museum. These expeditions were largely financed by small grants from interested friends of the institution.

Under Dr. Abbot the institution is expanding its researches in the physical sciences. The Astrophysical Observatory continued reduction of the measurements of solar radiation from the institution's observatories in Chili, South Africa and California. The growing mass of data will in time enable the institution to determine whether there is any periodicity in solar radiation and whether it will be possible to forecast weather for long periods ahead on the basis of this periodicity.

Cooperating with the New York Commission on Ventilation, the institution has determined what the cooling of the human body by radiation and convection is, fundamental data for the determination of proper ventilation for school and assembly rooms. In cooperation with the Fixed Nitrogen Laboratory, research has been started on relations of radiation to plant growth and on the measurement of certain ultraviolet rays. This is being made possible largely through a grant of $15,000 from the Research Corporation of New York.

The record of publications for the year is 117 volumes and pamphlets, of which there were distributed altogether 183,198 copies. The International Exchange service, which was organized by Secretary Henry in 1850, sent abroad to 54 countries a total of 486,789 packages of scientific and governmental publications and received for distribution in this country 55,434 packages.

Among the activities reported by the Bureau of American Ethnology for the year were the studies made by Mr. J. P. Harrington among the Santa Barbara Indians of California. For the first time the history of Alta, California, from the Indian viewpoint, was studied, throwing much light on hitherto dark chapters. Among other things these studies proved that Cabrillo was the discoverer of Monterey.

The International Catalogue of Scientific Literature continues to catalogue American scientific publications, though the public is largely deprived of the benefits of this work through lack of means for publication.

Eighty-seven donors, including President Coolidge, presented to the National Zoological Park during the year 138 specimens. Among these were a shoebill stork and two red birds of paradise from the Walter P. Chrysler fund.

The Smithsonian Library notes two important gifts during the year: the Chinese Library of the late Honorable William Woodville Rockhill, traveler, scholar and U. S. minister to China, and 3,500 volumes of serial and society publications, many of which are out

of print, from the American Association for the Advancement of Science.

The National Gallery of Art is unable to record much progress for the year due to the lack of a building for the exhibition of material, other than the small space available to it in the Natural History Building. The outstanding gift of the year was the Thomas Moran painting of the Grand Canyon of the Yellowstone, presented by Mr. George Dupont Pratt.

SPECIAL ARTICLES

THE SHAPE OF CORK CELLS: A SIMPLE DEMONSTRATION THAT THEY ARE TETRAKAIDECAHEDRAL

IN SCIENCE, June 18, 1926 (pp. 607–609), the author reviewed his papers which seem to show conclusively that cells in masses are typically tetrakaidecahedral—a shape significant since Lord Kelvin had found that tetrakaidecahedra solve the problem of dividing space, without interstices, into uniform bodies of minimal surface. Lord Kelvin's mathematics was called in question in SCIENCE, September 3, 1926 (pp. 225–226), and, as expected, was promptly vindicated (Matzke, *Bull. Torrey Bot. Club*, 1927, 54: 341–348; Gross, SCIENCE, August 5, 1927, 66: 131–132). But that massed cells are tetrakaidecahedral seems to have found no general recognition since its announcement in 1923, based then on the forms in elder pith only. Accordingly an inescapable and extremely simple demonstration that a cork cell, on the average, makes fourteen contacts with the cells which surround it, is here presented.

A tangential section of commercial cork shows that the cells when cut in that plane are, as an average, hexagonal. But when these cells are cut lengthwise, which happens when cork is sectioned either radially or transversely in relation with the tree-trunk, then—in the words of Hooke's "Micrographia"—the cells or pores are seen to be "not very deep, but consist of a great many little boxes separated out of one continued long pore by certain diaphragms." Thus eight surfaces are accounted for—an inner and an outer diaphragm, and six lateral surfaces. But it is readily seen that each lateral surface usually makes contacts with *two* cells—sometimes with only one, sometimes with three, yet on the average with two—so that there are twelve lateral contacts. These, with the two diaphragms, complete the count of fourteen. There are, however, innumerable exceptions, and it is expedient to verify our premises.

In a recent paper on the epidermal cells of the cucumber, we have discussed, with the aid of a mathematician, the geometrical requirements of an epithelial mosaic.[1] Thus we are prepared to find that the average number of sides of cork cells in cross section—that is, in a tangential section of cork *in situ* on the tree—is slightly less than six, the deviation depending on the frequency of tetrahedral angles. Such angles, or places where four cells meet at a point, are somewhat more common in the thick-walled and apparently less mobile cork cells than in those of cucumber rind when cut in the same plane. A count of the sides of one thousand cork cells yields results shown in the accompanying table. Though less than half of the cells are hexagonal, the average number of sides is 5.978. Accordingly no error has been made in assuming that the typical cork cell is six-sided in cross section.

1000 CORK CELLS IN CROSS SECTION

Number of cells with						
4 sides	5	6	7	8	9 sides	Average
18	250	491	213	27	1	5.978

Turning next to the vertical sections of cork cells, it is seen that they, too, are commonly hexagonal. Of a thousand taken at random, 521 were hexagons. But tetrahedral angles are more frequent in this plane than in the other, so that the average number of sides is only 5.877. The distribution of the various types of polygons, yielding this average, is shown in Table 2.

1000 CORK CELLS IN VERTICAL SECTION

Number of cells with							
3 sides	4	5	6	7	8	9	10 sides
2	50	241	521	152	31	2	1

What is perhaps a typical vertical section of a cork cell has been drawn in Fig. 1, *g*. It is oriented so that its "diaphragms," or inner and outer surfaces, are above and below in the picture. Each lateral surface is in contact with two cells. With the production of a tetrahedral angle, one of these surfaces would be eliminated. Thus cell *a* in the figure is in contact with cell *e*,

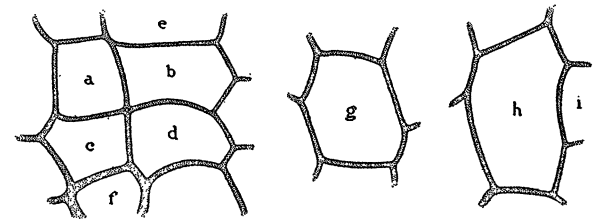

FIG. 1

and *f* with *d*, but cell *c* has lost the corresponding contact with *b*, and cells *a*, *b*, *c* and *d* meet at a point. Cell *b*, therefore, has only one contact on its left side, which is true also of cells *a* and *i*. But cell *h* has three contacts on its right, as would be true of cell *a* if it should expand toward *d* and thus avoid the tetrahedral

[1] *Anatomical Record*, 1928, 38: 345–350.