an opening of about 2 microns in diameter. There are usually four or five tubes in large sporangia and one tube in small sporangia.

The zoospores are somewhat ovoid in form, 4 to 8 microns in length and very flexible. The single cilium, 30 to 50 microns in length, is attached at the broader posterior end and trails behind when the spore is actively swimming. There is usually one bright eyespot, but there may be two. Conjugation of zoospores has not been seen in my cultures.

Within twelve hours after leaving the sporangia most of the zoospores settle down at the margin of the hanging drop and become rounded in form. A single germ tube develops and grows out from the edge of the drop and along the surface of the cover glass. If the spore has come to rest too far from the margin, the mycelium grows downward and projects from the drop of water. The tube may reach a length of 10 to 20 microns in 24 hours after the zoospore has left the sporangium. The mycelium usually branches freely and irregularly after it reaches a length of about 10 microns. In cultures 9 days old the mycelium averaged about 20 microns in length. It varied from 10 to 60 microns (total length of branches).

Old galls are likely to contain nematodes, Paramœcium and other ciliate protozoa, several kinds of flagellates and amoeboid protozoa. Some of these feed on the zoospores, as many as 30 having been counted in a single Paramœcium. Cultures free from these organisms were obtained by transferring ripe sporangia, by means of a mechanically operated micropipette, into hanging drops of water. The zoospores escaped from the sporangia and sent out germ tubes in these cultures.

Much difficulty was encountered in finding galls with spores that would germinate. Even in such galls, only a very small percentage of the resting spores germinated. In some cases the zoospores escaped when the hyaline wall was extruded only slightly through the fissure in the brown wall. Usually the sporangium became entirely free before the spores were released.

Hanging drop cultures of spores from several galls produced sporangia for about two weeks. Attempts to hasten the release of zoospores by keeping these cultures on ice over night were not successful. Cultures containing sporangia were allowed to become partially dry for a few minutes and then moistened again. This effected the escape of zoospores from ripe sporangia. It did not change sporangia appreciably in which the contents had not become differentiated into spores.

Germination was obtained in November (1906) and in March, April, May, June and July (1920).

C. Emlen Scott

Botanical Laboratory,
Stanford University,
California

SCIENTIFIC BOOKS

Hand-List of Scientific Manuscripts in the British Isles dating from before the Sixteenth Century. By Dorothea Waley Singer. London, De La More Press, 1919. 8o. 12 pp.

Survey of Medical Manuscripts in the British Isles dating from before the Sixteenth Century. By Dorothea Waley Singer. London, J. Bale, Sons & Danielsson, Ltd., 1920, 8o, 12 pp.

These are important contributions to the early history of medieval medicine and science, the first fruits of a catalogue of some 30,000 scientific manuscripts of the Middle Ages, found in Britain, and now in preparation by Dr. Singer and his wife. The value of such a catalogue to future students will be incalculable, going forward as it does simultaneously with the cataloguing and intensive study of the scientific and medical incunabula. As the social and scientific history of modern medicine is to be found largely in the files of medical periodicals of the eighteenth to the twentieth centuries, so the unwritten history of medieval science is contained in the manuscripts, the pathway to which lies through the early printed books.

Until very recent years, the history of medieval science has been regarded with mingled feelings, whether of indifference or aversion, due to the fact that real knowledge of the subject, as based upon the elliptical data in the printed literature, is so meager as to be deceptive, while what little is known has been constantly misread, over-stated or misinterpreted, according to the religious bias of the expositors. Until Sudhoff began to photograph and interpret the hitherto undiscovered medical manuscripts on the continent of Europe, such valuable source-books of medieval folk-medicine as Oswald Cockayne's "Leechdoms, Wortcunning and Starcraft of Early England" (1864–6) remained undisturbed on the dustier shelves of libraries. But with the foundation of the Leipzig Institute (1905), things began to take a new turn. The classified hand-list of manuscripts which Dr. and Mrs. Singer are making is an important move in aid of the problem: "How are we to trace the disintegration of Greek science in the Middle Ages and the slow processes which led to the apparently sudden rise of the experimental method?" Before we can investigate the great mass of undigested manuscript material, we must first have a reasoned catalogue; while to catalogue all the manuscripts in a single country is the first step to a classified "world catalogue" of such manuscripts. Encouraged by grants from the Royal Society and the British Academy, the Singer catalogue has already progressed far enough to enable its compilers to block out their classification by subjects. This list of subjects, replete with such rubrics as Aristotle, Menology, Bestiaries, Magic, Cosmology, Herbaria, Lapidaries, Marvels, Melothesia Physiognomy, Cheiromancy, etc., already affords a glimpse into the medieval mind; and could we conceive of a medieval scientific library, public or private, as attaining to any great size (impossible by reason of the costliness of the illuminated manuscripts and printed incunabula), we should have an inkling of the probable arrangement of its books, by alcoves and shelves. Some 15,000 of these manuscripts are medical, and, of these, 1,900 are on general medicine, 953 alchemical, 600 magical, 194 surgical, 178 gynecological, 72 pediatric, 144 veterinary, 274 on pulse-lore, 274 on uroscopy, 234 on blood-letting, 144 on diet, 18 on fevers, 90 on the pest, 63 on the eye, 600 on herbs and simples, 114 on physiognomy and cheiromancy, 106 on generation, while no less than 669 are bestiaries and 2,500 collections of recipes. These figures at once give a better notion of the extent to which medicine was followed in the Middle Ages, than any existing lists of medical incunabula. Most of these manuscripts were written between 1200 and 1500 A.D., and but few before the eighth century. Mrs. Singer shows by curve-tracing their distribution in time, the curve taking an abrupt and constantly upward slope after the thirteenth century. The second paper (1920) concludes with a highly instructive set of 34 legends for lantern slides of specimen pages.

F. H. GARRISON

ARMY MEDICAL MUSEUM

SPECIAL ARTICLES

THE ARRANGEMENT OF ATOMS IN SOME COMMON METALS

DURING the past year the crystal structures of several elementary substances have been determined. A brief summary of the results will be given here. Complete data will be published in the *Physical Review*.

The method is the same as that previously used.[1] A narrow beam of monochromatic X-rays is passed through the powdered material to be analyzed and produces on a photographic plate a pattern of fine lines. These lines are due to the reflection of the X-rays from the faces of the tiny crystals, one line for each kind of face. From the positions and intensities of the lines the crystal structure can be calculated.

CALCIUM

Calcium has generally been considered hexagonal, partly from analogy with magnesium

[1] *Phys. Rev.*, 10, 661, 1917; *Proc. A. I. E. E.*, 38, 1171, 1919. See also Debye & Sherrer, *Phys. Z.*, 18, 291, 483, 1917.