These experiments, and others of the same sort, seemed to indicate that sand filtration gives reasonably accurate results if the sand used be as fine as .3 mm. The crucial test of this point, however, must be made by drawing a given sample of air through sand filters and a culture bottle, so arranged in tandem that the bacteria which pass the sand shall be collected in the bottle. The table below shows a series of such experiments and makes it clear that the efficiency of the filtration method depends upon the size of sand grain employed.

RELATIVE NUMBER OF BACTERIA PASSING THROUGH SAND FILTERS; AND RETAINED IN THEM

Air Examined	Bacteria per Liter Retained in Filter		Bacteria per Liter Passing Filter
	Two 2.5 cm. Layers of .1–.3 mm. Sand	One 5 cm. Layer of .5–1 mm. Sand	
Suspension, *B. prodigiosus.*	100		2
Street air.	94		1
Suspension, *B. coli.*	2,640		12
" "		175	304
" "	4,000		37
Suspension, *B. prodigiosus.*		1,700	3,500
Suspension, *B. prodigiosus.*	14,000		2,400
Suspension, *B. coli.*	40		12
" "	90		15
" "		165	105

In seven tests with tandem sand filters, each containing 2.5 cm. of sand, with grains between .1 and .3 in diameter, the bacteria passing the sand were—once 30 per cent. of the number retained by the sand, twice 17 per cent., once 2 per cent. and three times 1 per cent. or less. On the other hand, in three tests with the Sedgwick-Tucker apparatus holding a single layer of sand, 2 cm. deep with grains between .5 mm. and 1.0 mm., nearly half the bacteria present passed the sand in one case and about two thirds escaped in the other two instances.

It seems clear that sand over .5 mm. in diameter is inadequate for filtering out bacteria. On the other hand, a sand finer than .3 mm. is generally efficient though not wholly reliable, since at times it allows a considerable proportion of bacteria to pass. This is not remarkable when the relative size of sand and bacteria is considered.

It is, of course, obvious that sand can not operate in the removal of bacteria by any process which can properly be called straining. In an editorial discussion of the removal of fine particles from water the *Engineering News* (LIX., 344) has described the phenomenon as "adhesion"; and the term deserves general acceptance in this connection. The size of the sand must affect the removal of fine particles in two ways. First, in a given depth, the number of surface contacts, which permit adhesion, must vary inversely with the size of the particles. Second, the velocity of flow, which tends to tear off adhering particles, must, under given conditions, increase with the size of the particles. Coarse sand might, therefore, be used with success by filtering through a deeper layer and by cutting down the rate of flow. It is simpler, however, to use sand sufficiently fine to regulate the rate of filtration automatically.

On the whole, the culture-bottle method seems to offer a more accurate procedure for bacterial examination of air than any yet available. The sand-filter method is fairly accurate as a rule, but occasionally gives low results. The filter method is more convenient than the culture bottle method for examinations outside the laboratory, since for the latter it is necessary to carry two 1,500 c.c. bottles for each examination. Aside from this difficulty of transportation, however, the technique of the culture-bottle method is to be preferred. Bottles are easier to prepare and to sterilize than sand filters and the actual examination is simplified by the omission of sand washing and subsequent plating.

C.-E. A. WINSLOW
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

SOCIETIES AND ACADEMIES

THE NEW YORK ACADEMY OF SCIENCES, SECTION OF ASTRONOMY, PHYSICS AND CHEMISTRY

A meeting of the Section of Astronomy, Physics and Chemistry was held at the Museum of Natural History on Monday, January 20, at 8:15 P.M.,

Professor D. W. Hering in the chair. Professors Lamb, Rosanoff and Breithut read a paper on "A New Method of Measuring Partial Vapor Pressures in Binary Mixtures."

On Monday, March 16, Professor W. Campbell read some "Notes on Metallography applied to Engineering." The methods of preparing specimens, development of structure, microscopic examination and photographing the specimen were briefly reviewed. The structure of metals, ingotism and grain structure, the effects of strain and of annealing were demonstrated and the constitution of alloys, mattes, speisses, etc., taken up. The carbon-iron series, the graphite-austenite and cementite-austenite groups were discussed and illustrated. Examples of structure were given; wrought iron *vs.* low carbon steel, good and bad material; working and annealing of medium carbon steel; rails and examples of their failure; steel tyres and shelling out; the structure of hypereutectic steels and their change with heat treatment; cast iron, gray, mottled, white, spiegeleisen; cementation and blister steel; malleabilizing and the formation of temper carbon.

The application of metallography to economic geology was shown by demonstrating the paragenesis of certain mixed sulphide ores, of silver ores from Cobalt, Ont., of the Butte copper ores, of typical "enrichment zones." The constitution of so-called nickeliferous pyrrhotites and of certain complex opaque minerals was shown. Many lantern slides were used to illustrate the paper.

A sectional meeting was held on Monday, May 18. Dr. J. P. Simmons presented a "Note on a Curious Effect produced by the Explosion of Detonating Gas." When a mixture of oxygen and hydrogen is exploded in a tube, the inside of which is coated with a thin layer of water, perfect rings are formed. The same phenomenon has been noticed when the same kind of a gas mixture is exploded in a tube, the inside of which is coated with a thin layer of wax. This is a heating effect, since the rings formed in the tube covered with wax are made apparent by the melting of the latter substance. This periodic heating is probably due to compressions arising from either sound or explosion waves.

W. Campbell and R. F. Böhler read a paper on the heat treatment of carbon tool steels. The various constituents of unhardened and hardened high carbon steels were first classified, cementite, pearlite, ferrite, graphite, austenite, martensite, troostite, osmondite and sorbite, and the views of the different authorities on their constitution given in tabular form. The plan of study embraced (1) heating to various temperatures and (*a*) slow cooling, (*b*) quenching, (*c*) tempering; (2) the effects of forging temperature and quenching temperature, to see whether the structure gave any evidence whether overheating had taken place during forging at the works of the manufacturer or during reheating for hardening at the user's, in the case of faulty material; also whether this persisted after tempering. Only the maximum forging temperature left any traces after quenching and this was much above that used in practise. Tables and curves showing variation of physical properties with heat-treatment were given, and the various structures illustrated by numerous lantern slides.

Professor Charles L. Poor presented two papers by title, (1) "An Investigation on the Figure of the Sun and of Possible Variations in its Size and Shape," (2) "The Photoheliometer."

William Campbell,
Secretary
Columbia University

The Chemical Society of Washington

At the 183d meeting of the Chemical Society of Washington, held at the Cosmos Club, May 14, 1908, the following papers were presented: "Influence of Fine Grinding on the Water and Ferrous Iron Content of Minerals and Rocks," by W. F. Hillebrand, and "Technical Value of Wood Turpentine," by F. P. Veitch.

Mr. Bailey Willis, of the Washington Academy of Science, addressed the society in regard to a proposed scientific weekly. The following resolution was then adopted:

Resolved, That it is the sense of the society that the new journal is desirable and, further, that it will be welcomed by this society.

The meeting was presided over by President Joseph S. Chamberlain, and the attendance was 48. President Bogert also addressed the society on problems of general interest to the members of the Chemical Society.

A special meeting of the society was held at the George Washington University Lecture Hall on May 9, 1908. President Chamberlain introduced Dr. C. A. Ernst, the speaker of the evening, who gave an address on "Viscose and Artificial Silk." The lecturer showed many samples of artificial silk, and explained the process carried on at the Genasco Silk Works of Lansdowne, Pa. The attendance was 65.

J. A. LeClerc,
Secretary