

and Steelmaking Furnaces," "Shaping and Forming," and "General Metallurgy." Members are urged to address all communications with reference to luncheon and dinner reservations to: S. A. Maxon, Assistant Secretary, American Iron and Steel Institute, 350 Fifth Avenue, New York 1, New York.

COMMENTS

by Readers

Recent Deaths

Herbert S. Jennings, 79, research associate at the University of California since 1938 and professor emeritus of zoology at Johns Hopkins University, died April 14 in Santa Monica, California, after a year's illness.

Halsey J. Bagg, 57, research biologist who had devoted much of his life to the study of cancer, died April 13 in Yorktown Heights, New York.

William Stanley Marshall, 80, professor emeritus of zoology at the University of Wisconsin, died March 17 in Madison. He published many papers on the anatomy and embryology of insects. A collection of Wisconsin beetles, which he assembled, was left to the University of Wisconsin.

I. Seymour A. Hadwen, 70, former director of the Department of Pathology and Bacteriology, Ontario Research Foundation, and past-president of the American Veterinary Medical Association, died April 18 in Toronto.

Make Plans for—

New York State Geological Association, 19th field meeting, May 9–10, New York City.

Federation of American Societies for Experimental Biology, May 18–22, Chicago, Illinois.

American Association of Cereal Chemists, 32nd annual meeting, May 19–23, Hotel President, Kansas City, Missouri.

American Oil Chemists' Society, 38th annual meeting, May 20–22, New Orleans, Louisiana.

American Society of Mechanical Engineers, oil and gas power 19th national conference, May 21–24, Cleveland, Ohio.

A number of biological papers involving work in which a centrifuge is used are published each year. In an appreciable percentage of these, reference to the amount of centrifuging to which a given material is subjected is presented in terms of duration of centrifuging and the speed of the centrifuge. Such figures, alone, are quite meaningless. Centrifuging data should include duration of centrifuging and the magnitude of the applied centrifugal force. It is possible to centrifuge material at 3,000 r.p.m. (or even at 3,000 r.p.s.) and subject it to little or no centrifugal force, if the material is near or at the center of rotation.

The centrifugal force, in terms of gravity, can be easily calculated if one knows the speed of the centrifuge and the distance of the material from the center of rotation. Heilbrunn (1921) gives the formula

$$c' = \frac{4\pi^2 n^2 r}{g},$$

where n = the number of revolutions per second, r = the distance of the material from the center of rotation in centimeters, g = the gravitational constant, and c' = the centrifugal force in terms of gravity. The figure 39.478 may be substituted for the constant $4\pi^2$. Shapiro (1935) has published a useful monogram for obtaining c' if n and r are known.

It is important to stress the fact that r represents the distance of the material from the center of rotation and not the length of the centrifuge arm or the external radius of the centrifuge. The centrifugal force at the outer periphery may be far greater than the effective force, since the material being centrifuged is nearer the center of rotation by the thickness of the outer wall of the centrifuge plus the thickness of the bottom of the centrifuge tube plus the thickness of the layer of supporting medium (if present).

Furthermore, it is not sufficient to state the speed of the centrifuge and the type of centrifuge employed, since most centrifuges have interchangeable heads of different diameters. It is true that, for any given centrifuge with a given head, the speed of rotation and the duration of centrifuging are the variables and the distance of the material from the center of rotation is usually constant. Nevertheless, the latter can be varied by changing the centrifuge head or by altering the method of suspending the material in the centrifuging medium.

Editors could do much to remedy the present situation by insisting that authors either state the centrifugal force employed or give both the speed of the centrifuge and the effective distance from the center of rotation. The former procedure is definitely preferable, however, since it is more concise, saves the reader a task of calculation, and avoids the possibility of subsequent misquotation in terms of centrifugal speed alone.

If the centrifugal force employed in a given set of experiments, particularly on such material as living marine egg cells, is unknown, it is frequently impossible to repeat these experiments and obtain the same result. Rate of sedimentation of the granules and vacuoles of living cells under low centrifugal forces is markedly retarded by redistribution of these inclusions by Brownian movement, as Howard (1931) carefully pointed out.

Among the numerous pieces of work on biological material marred by the oversight of stating centrifugal speed rather than centrifugal force, or entirely omitting mention of magnitude of centrifugal force employed, are those of Boveri (1910), Hertwig (1904), Morgan (1935, 1937), Parseval (1922), Raven (1938), Ries (1939), Wilber (1945), Wilson (1929, 1930), and many others. (DONALD P. COSTELLO, *Department of Zoology, University of North Carolina, Chapel Hill.*)