bacteria therein.* When the solid surface in stored sea water is increased tremendously by the addition of silicious sand or inert colloidal substances, the total bacterial population reaches only 10 to 100 million per cc. including estimated periphytes. Upon the addition of a little organic matter it greatly exceeds this number regardless of the volume of the receptacle in which the water is stored or the area of solid surface. However, when more than 10 mg. of nutrient material such as peptone is added per liter of sea water, the proportion of periphytes which develop is decreased. In sea water containing more than 100 mg. of peptone per liter the beneficial effect of solid surfaces is masked by the great abundance of bacteria which appear in the water. Under these conditions bacterial activity in large volumes of water is just as great as in small volumes. ZoBell and Anderson[2] have advanced a theory to account for these phenomena and the studies are being continued.

8936 C

Quantitative Determination of Vibratory Sensibility.

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The determination of the threshold of vibratory acuity is a valuable part of the neurological examination, particularly in the diagnosis of lesions affecting the posterior columns of the spinal cord. There have been numerous studies in which an attempt has been made to obtain a quantitative measure of acuity. The tests have all been made with a tuning fork of some description, usually with some device designed to measure the intensity of the vibration, an end which, in the opinion of the workers themselves, was not satisfactorily attained.

We have, therefore, constructed an instrument which produces a vibration of constant frequency, the intensity of which can be varied over a considerable range, and measured accurately. It consists of an iron pole-piece which constitutes the vibrating member, and to which is attached a round, metal button 12.5 mm. in diameter which is placed over the bony prominence to be tested. This pole-piece

* According to Krogh and Keys (*Biol. Bull.*, 1934, **67**, 132), natural sea water contains less than 10 mg. organic matter per liter, much of which is not utilizable by bacteria.

is actuated by an electromagnet energized by an alternating current of 60 cycles per second. By means of a potentiometer this current may be varied, and its strength measured by means of an alternating current milliameter in series with the magnet winding. Thus the amplitude of vibration, roughly proportional to the current flowing through the electromagnet, is subject to control and measurement. Since the intensity of vibration bears no absolute relation to the amperage, depending on the design of the coil in the particular electromagnet, this intensity is expressed in arbitrary units from 0 to 10. Each individual instrument should, therefore, be calibrated to correspond to the original one used as a standard. An even pressure is maintained by allowing the instrument to rest by its own weight over the bony prominence, the operator merely supporting the end of the handle. Thus the intensity of the stimulus for any given scale reading is constant from time to time or from individual to individual.

Pearson,[1] who reviewed the literature on this subject, noted a considerable variation of vibratory acuity with age, the threshold increasing markedly after the fifth decade. We have, therefore, determined the vibratory acuity of 125 individuals apparently free of central nervous system disease. Figs. 1 and 2 illustrate graphically the decade averages for vibratory sensibility as determined over the patellae and medial malleoli of these patients. Each number is the average of the appearance and disappearance threshold for

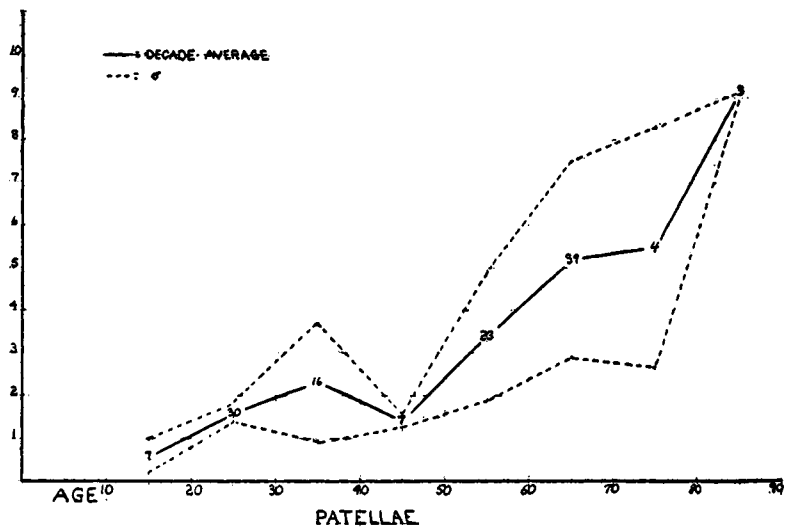

FIG. 1.

[1] Pearson, G. H. J., *Arch. Neurol. and Psychiat.*, 1928, **20**, 482.

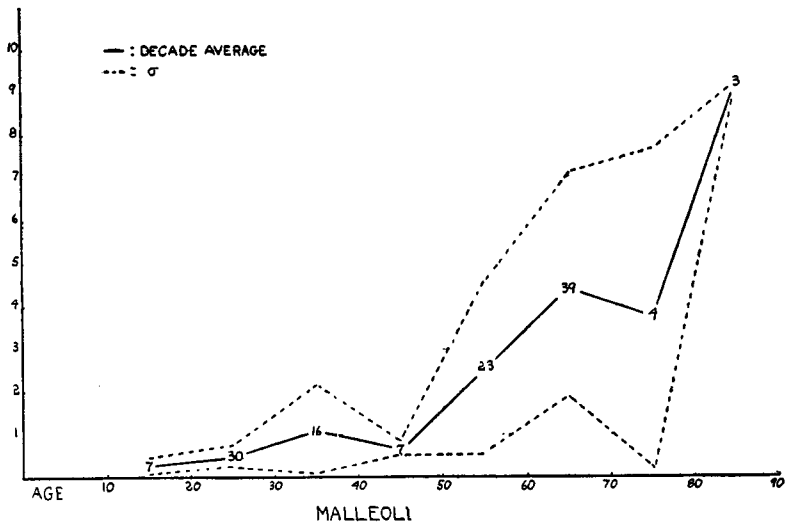

FIG. 2.

both sides. We feel that this average is a more accurate indicator than either the average of the appearance or disappearance threshold taken separately. The field between the broken lines represents the standard deviation computed for each decade average.

A gradual increase in the average threshold with age is apparent. Since the standard deviation also increases with the age of the group, a decrease of vibratory sensibility in the upper decades must be considerable to be of any significance. The 3 individuals over 80 were unable to detect any vibration with our instrument.

We intend to determine vibratory acuity in a much larger number of normal subjects, so that we can, if possible, present more definite limits for the normal range of this sensibility for the different age groups, as a preliminary to the determination of vibratory sensibility in disease. We have already determined the vibratory acuity of 90 patients suffering from arthritis of Ely's type II by this method, but only one age group is large enough to justify a report.

Examination of Figs. 1 and 2 shows the average threshold for normal individuals in the seventh decade to be 4.4 over the medial malleolus and 5.2 over the patella. Similar determinations made on 25 arthritic patients in the same age group showed the value over the medial malleolus to be 6.25 and 6.8 over the patella. The standard error of the difference between normal and arthritic patellae is 0.587, and that between the normal and arthritic malleoli, 0.753. The actual difference between the two means is 1.6 for the patellae, and 1.85 for the malleoli. Since this actual difference is 2.7 times

the standard error of difference for the patellae and 2.4 times that for the malleoli, it probably is significant.

Our finding of increased vibratory acuity threshold with age is in accord with the work of Corbin and Gardner,[2] who found a decrease in the number of myelinated fibers in the spinal roots in man with age and with similar findings of Duncan[3] in the rat. This would seem to imply that arthritic patients have a greater loss of proprioceptive fibers than a similar age group of normals. The possible implication of this finding in the etiology of this type of arthritis must be borne in mind.

8937 P

Effect of Benzedrine Sulfate on Basal Metabolic Rate.*

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The use of benzedrine in narcolepsy has been advocated by several workers.[1, 2, 3] The results have been uniformly excellent, the drug affording complete relief from symptoms; no patients have failed to respond to adequate dosage. In the case-records reported, the basal metabolic rates recorded have averaged well below the normal range. It has been stated that the drug can awaken experimental animals from anesthesia produced by barbital given intraperitoneally.[4, 5] In humans, besides its profound effect in narcolepsy, it has produced also marked cerebral stimulation, insomnia, and rise in blood-pressure; this occurs in normal individuals, likewise. One would expect, therefore, that benzedrine would markedly increase metabolism, most probably indirectly through its stimulative action.

The following study was undertaken to determine the metabolic

2 Corbin, K. B., and Gardner, E., Personal communication.

3 Duncan, D., *J. Comp. Neurol.*, 1934, **59**, 47.

* Assisted by a grant from the Christine Breon Fund.

† Biochemist, University of California Hospital.

1 Prinzmetal, M., and Bloomberg, W., *J. A. M. A.*, 1935, **105**, 2051.

2 Ulrich, H., Trapp, C. E., and Vidgoff, B., *Ann. Int. Med.*, 1936, **9**, 1213.

3 Peoples, S. A., and Guttmann, E., *Lancet*, 1936, **230**, 1107.

4 Alles, G. A., *J. Pharm. and Exp. Therap.*, 1933, **47**, 339.

5 Alles, G. A., and Prinzmetal, M., *J. Pharm. and Exp. Therap.*, 1933, **48**, 161.