3. After preliminary feedings on two adjoined units animals commonly explore rapidly. Quickly exhausting the area at any one location they go on. Rats well used to this kind of maze run the pattern in Figure 1 without mistake on as early as the 4th to 6th trial, and some well used to the pattern have covered it in as short as 10 sec. Corners may be cut.

4. Tracking does not seem to play a very important rôle. Each maze unit may be quickly turned end for end. All the culs-de-sac will thus be placed in the true path. This seldom seems to make any difference in the next run.

5. Vision is often used in general orientation as may be shown by the promptness with which many animals notice a maze unit that is set in somewhere out of contact with the general pattern. They will reach and often cross the 5 inch gap to this isolated unit (which may be new or old), explore it and then return.

6. Balance at rapid turns or at the time of a mis-step is obviously aided by movements of the tail. Not infrequently the animal may stand high up on its hind legs. This was noted by Vincent.

7. The introduction of short cuts, alternate paths, gaps and other obstructions produce easily observable changes in behavior, which may be recorded by motion pictures apparently without distraction to the rat. This is a preliminary report.

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1 Vincent, S. B., *Behavior Mono.*, 1912, i, 1-81.

* Vincent reported that falls happened from the ends, turns and "frequently from sides midway." Our experience does not agree. Possibly her animals were too well used to the same floor pattern in the alley form, *i. e.*, with the sides turned up.

3415

Observations On Hearing-Acuity For Bone-Transmitted Sound.

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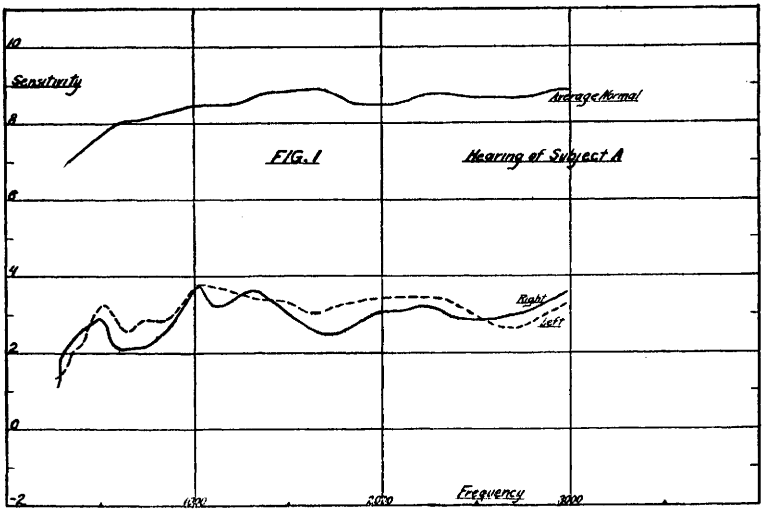
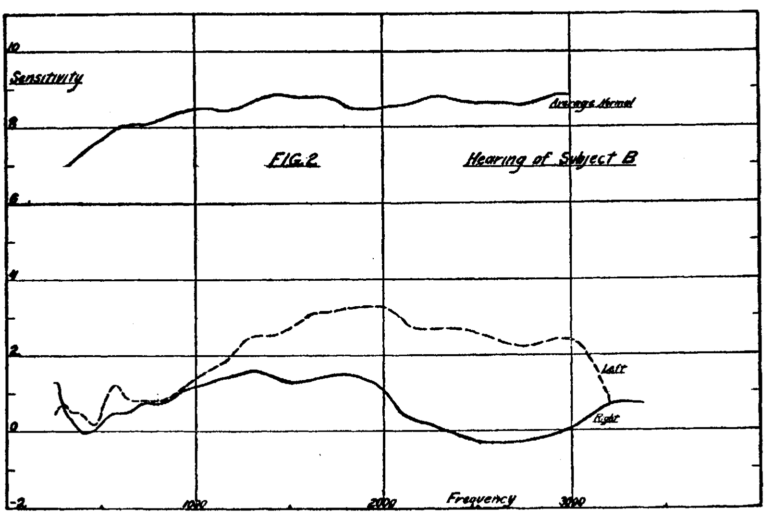
The writers have demonstrated that bone-transmitted sound follows at least part of the pathway to the labyrinth taken by air-transmitted sound. It has also been determined that the acuity for air-transmitted sound is not necessarily a criterion for the bone-sensitivity, or *vice versa*. The writers have reported elsewhere[1] the quantitative findings in two cases of deafened individuals who claim to hear better in a noise. While these two individuals belong to the *paracousis Willisi* type, they were found not to have unusual bone-sensitivity. Deafened people do not really hear better in a noisy place; rather it is the normal individuals who do not hear so well.

Acuity for Air-Transmitted Sounds. Figures 1 and 2 show the acuity for air-transmitted sound of the two subjects included in this report. The acuity is given in terms of the logarithm of the reciprocal of the necessary intensity for hearing, and a difference of one unit in sensitivity corresponds to an intensity ratio of 10, two units



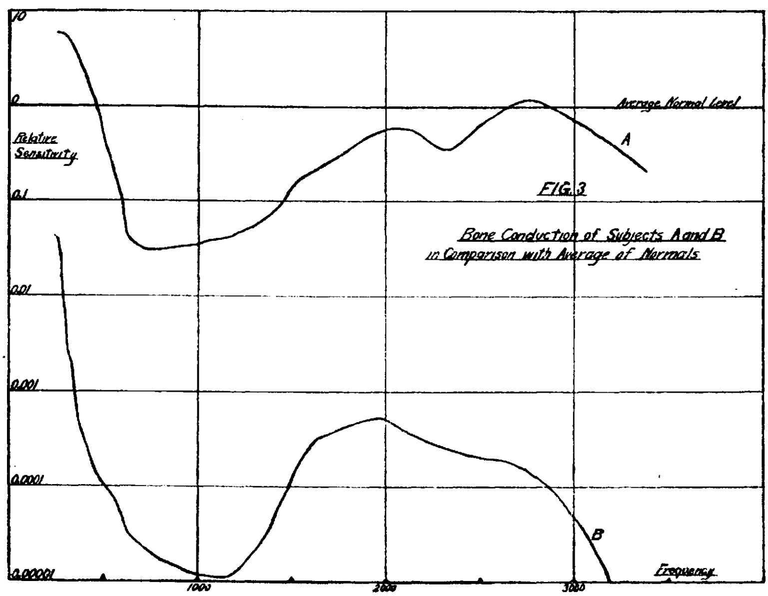


to 100, etc. The average sensitivity of normal hearing people is also shown.

The sensitivities of the two ears of subject A are about alike and average about 3.0, while the average normal curve has a height of about 8.5, giving a difference of 5.5. This would indicate that it takes about $10^{5.5}$, or about 300,000 times normal intensity for subject A to hear. Similarly subject B requires about 100,000,000 times normal intensity for the right ear, and 3,000,000 times normal intensity for the left ear. Qualitatively, subject A by paying attention, experiences no marked difficulty in conversing with normal people. On the other hand, normal people must speak very loudly in order to make subject B understand them. Incidentally it may be remarked that subject A hears conversation only a trifle better with ears open than with external auditory canals occluded.

The measurements were taken with the continuous-tone-range audiometer previously described,[2] and a calibrated telephone receiver was used for the sound production.

Acuity for Bone-Transmitted Sounds. Figure 3 shows the acuity of the two subjects for vibrations transmitted to the forehead by means of the bone-activating receiver, as described in previous papers.[3] The average normal level for bone-transmission acuity was obtained by averaging the measurements on several observers of normal air-acuity. The figures at the left show the comparative in-



tensities of vibration. The form of the curves for the two subjects is similar. The bone-acuity curve of A shows a departure from the average normal about equal to the most extreme departures in the 7 individual measurements used in obtaining this norm. The curve for subject B shows very distinct deficiency in bone-acuity. This deficiency amount to as much as a factor of 100,000 times normal for part of the frequency range. In the region of 1,000 cycles per second and 3200 cycles per second 100,000 times the normal amount of energy applied through the bone-activating receiver was required to produce an audible impression upon subject B.

The effect on bone-sensitivity through occlusion of the external auditory canals with dental impression compound was tried and found to be negligible in both subjects. The small differences were well within the observational error. This observation differs from the results obtained on normal-hearing people given in a previous paper. The occlusion of the external auditory canals improved the average bone-acuity in normal-hearing individuals. This improvement, tested from the forehead, increased with the decreasing frequency from 2600 cycles per second to 256 cycles per second, and amounted to a factor of about 50 in the required energy at 256 cycles.

Acuity for Hearing Under Other Test Conditions. On testing subject A with tuning forks of 256 and 512 cycles per second, it was found that he could hear these forks placed at his open mouth as well as he could when placed at his external auditory canals. He did not hear these forks when placed at the side of his cheek. Clenching the teeth also appeared to make a difference in his acuity for air-transmitted sound. Tests were therefore made on subject A for various conditions of hearing air-transmitted sound at frequencies from 256 to 1500 cycles per second. The sound was produced by a telephone receiver lying on a soft pad about 30 inches in front of the observer. The acuity under the different conditions imposed was compared by varying the current through the receiver and measuring the minimum current necessary for hearing the tone under each condition. The observations were taken in a room lined with felt and interference effects from standing waves were at a minimum.

The different conditions tested were: 1. with mouth closed; 2. with mouth closed and teeth clenched; 3. with mouth wide open; 4. with mouth open to form an aperture and cavity such as to tune in or be resonant with the tone presented, as if whistling; and 5. an acoustical fan held between the teeth.

The acoustical fan is made of flexible hard rubber, fitted with a string which serves to pull the surface of the fan into a bowed or bent form and maintain it in this position. The fan is held by the handle with the top of the fan bent toward the person and the upper edge held firmly between the teeth.

TABLE I.
Acuity of Subject A under various conditions.

Frequency	Mouth Closed		Mouth Open		
	Mouth closed	Teeth clenched	Wide open	Mouth tuned	Fan used
384	Nothing heard	1.	1.3	67.	440.
512	1.	4.	1.3	29.	76,000,
768	1.	1.	1.	670.	12,100.
1024	1.	1.	0.4	—	2.1
1500	1.	1.	1.	—	1.

Table I gives the results of this series of tests. The numbers indicate proportional sensitivity under the various conditions. This proportionality, however, holds only for the different conditions at any one frequency, and not for the change of sensitivity with the change in frequency. Results on the frequencies of 256 and 320 cycles are not given in this table because the acuity was too low to obtain numerical results. However, for these two frequencies the conditions of clenched teeth and open mouth showed greater than normal sensitivity, and the fan was of distinct benefit.

When the fan was held between the teeth, the sensitivity was increased from 256 to 1024 cycles per second. Compared with the condition of closed mouth, the benefit derived was as high as a factor of 76,000 at 512 cycles per second. The advantage at 1024 cycles was too small to be certain or significant.

The only previously recorded measurements on the acoustical fan are given by Sabine.[4] In the individual tested, he found that there was perhaps a slight benefit at 256 and 512 cycles. The enhancement was not more than an intensity factor of 2, which is of negligible importance. He also found that this individual derived no benefit through use of the fan for conversational purposes. (This individual was diagnosed as a case of stapedial fixation.)

Clenching of the teeth was of advantage to subject A at the lower frequencies, but made no difference above 512 cycles. Opening the mouth was a slight aid to hearing at the lower frequencies. Tuning the mouth cavity in resonance with the pitch presented was of considerable help in acuity for the frequencies of 768 cycles and lower.

Subject B experienced considerable practical benefit to conversation through the use of the acoustic fan, in spite of the fact that his bone-acuity was so low that quantitative measurements were not possible. This subject derived no apparent benefit from opening his mouth, or attempting to tune his mouth cavity to the pitch to be heard, except at 1024 cycles, where the benefit was slight.

These tests with an acoustic fan would seem to indicate an available method which may be used by the otologist in determining the acuity for bone-transmitted speech; and if the diagnosis in the case reported by Sabine is correct, then the fan may be employed as an aid to the diagnosis of stapedial fixation. This is a complete report.

1 Pohlman, A. G., and Kranz, F. W., *Arch. of Otolarygol.*, 1926, iii, 136.

2 Kranz, F. W., *Phys. Rev.*, 1923, xxii, 66.

3 Pohlman, A. G., and Kranz, F. W., *Ann. of Otol., Rhinol. and Laryngol.*, 1925, xxxiv, 1224.

4 Sabine, P. E., *Laryngoscope*, 1921, xxxi, 819.

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The Development of Marked Activity in Ergosterol Following Ultra-Violet Irradiation.

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In a previous communication we showed that cholesterol which has been purified by means of bromination failed to develop antirachitic properties as the result of ultra-violet irradiation.[1] These experiments, as well as some others, led us to question whether it is the cholesterol itself which becomes active or some contaminating substance intimately associated with it.

Recently we have been conducting experiments with a preparation of ergosterol prepared from yeast. Ergosterol is an optically active sterol possessing three double bends and a hydroxyl radical. Its molecule therefore possesses two factors which have been found to be linked with the activation of cholesterol derivatives and allied sterols.[2] The ergosterol was irradiated with the mercury vapor lamp for one-half hour at a distance of one foot, then suspended in linseed oil and fed to rats in varying amounts. It was found to bring about a healing process of the bones when even as little as 0.003 mg. per capita daily was given. In tests in which irradiated