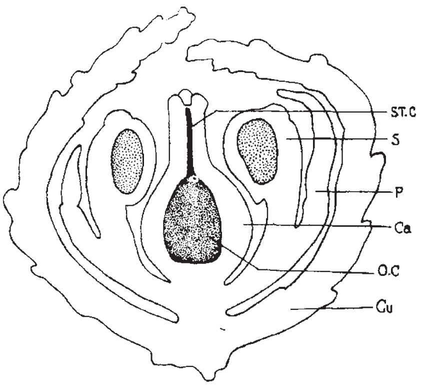
In the course of my investigations, I came across only one hermaphrodite flower (in microtome sections), which reveals that there are two opposite sepaloid perianth-segments or tepals, as described by Thoday and Johnson[5] in *Arceuthobium pusillum* Peck. In addition, there are two stamens adnate with the bases of the tepals. The anther is single-lobed. The ovary is superior (instead of inferior) and unilocular, and the stigma is trifid. Running from the cavity of the ovary throughout the length of the style is a prominent stylar canal. The complete flower is borne on a short pedicel, surrounded by a two-lipped cup (see diagram).



Section of a hermaphrodite flower of *A. minutissimum* Hook. f. × 425. *Cu*, cup; *O.C.*, Ovarian chamber; *Ca*, carpel; *P*, perianth segment; *S*, stamen; *St.C*, stylar canal

As I found[6] in the case of *Morus indica* Linn. (= *M. alba* Linn.), the occurrence of unisexual flowers in this species is also due to the arrest or reduction of one sex (male or female, as the case may be). These unisexual flowers are not simple and seem to be derived in the course of evolution from bisexual ones, which might have flourished very long ago. Hermaphroditism and hypogyny in this case are thus cases of reversion to their primitive nature.

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Frequency Differential Thresholds for Quality in Pure Tones

Attempts have been made to determine whether pure tones of equal loudness but different pitch are also different in quality, and whether it is possible to find frequency differential thresholds for the quality differences. Following the usual practice, the terms 'loudness', 'pitch' and 'quality' are used to refer specifically to auditory sensations, while 'intensity' and 'frequency' refer to characteristics of the sound-wave stimulus. In this preliminary work, the experimenter was the subject for the comparisons, which were made monaurally with an earphone.

It was found possible not only to observe quality differences, but also to describe them. The descriptions were always metaphorical and never altogether satisfactory but appeared to be fairly stable, that is, they seemed equally apt even after long periods of practice in listening and long rest periods over the course of several months. The following are typical of the listener's remarks: 500 c.p.s. sounds 'purer, clearer, more bell-like' than 125 c.p.s.; 250 c.p.s. sounds 'somewhat narrower, thinner and not so fuzzy' as 125 c.p.s.; 2,000 c.p.s. sounds 'sharp and hard' when compared with the 'soft, blunt, more comfortable' 125 c.p.s.; 1,500 c.p.s. has a 'reedy' quality not observed in 1,000 c.p.s. It seems relevant to note that few of the metaphors are drawn from volume or density concepts.

Convinced by these and other observations that pure tones may have different qualities, attempts were made to determine the minimum frequency-changes which would be accompanied by changes in quality, that is, to determine the frequency differential thresholds for the quality of pure tones. In the experiment an electronic switching device was used which, on pressing a button, presented the two sinusoidal sounds one after the other for equal time-periods with a short constant intervening silence. It was possible to select the frequency for either of the tones to be compared from throughout the auditory range. By means of separate attenuators and a 40-phon loudness-level chart for the listener's right ear, the loudness of the two tones was kept always equal regardless of frequency differences.

The method was to set the first tone of the comparing device at a base frequency (for example, 125 c.p.s.) with a loudness of 40 phons, and vary the frequency of the second, keeping its loudness constant at 40 phons. Thus 125 c.p.s. was compared with 135 c.p.s., then with 500 c.p.s., then with 200 c.p.s., and so on. For each comparison, a record was made of the frequency of the tones and whether or not a difference of quality was observed. Choice of frequencies for the second tone was more or less random until the general area of the differential threshold became apparent. Then frequencies were selected with the view of narrowing the area.

The accompanying figures are presented only as an indication of the type of finding looked for and as some proof of the plausibility of such research. Figures are averages of several trials, but represent both casual, as well as careful, observations.

Base freq.	*DL* in c.p.s. freq. increase	*DL* in p.c. freq. increase
125	Between 40 and 100	Between 32 and 80
500	150 280	30 56
1000	200 350	20 35
3000	400 1000	13 33
4000	600 1000	15 25

The second column is read thus: compared with 125 c.p.s., frequencies up to 125 + 40 = 165 c.p.s. showed no difference in quality, but frequencies above 125 + 100 = 225 c.p.s. were observed to be different in quality; observations between 165 and 225 c.p.s. were inconsistent.

It is concluded that differential thresholds for the quality of pure tones can be determined and that they will probably fall within the areas indicated.

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