Penicillium digitatum, however, germinated after about seven hours' but not after eight hours' treatment at 67° F. Germination was markedly retarded though not inhibited after fifty hours' treatment at 39°. *P. italicum* spores were affected in approximately the same manner as those of *P. digitatum*.

It does not appear to have been noticed previously that the oil glands of citrus fruits provide a favourable avenue for infection by *Penicillium*. That they do so further emphasises the necessity for the utmost care during the handling of citrus fruits.

G. R. BATES.

The British South Africa Company's
Citrus Experimental Station,
P.O. Mazoe, S. Rhodesia.
Oct. 12.

Zostera marina on Anticosti Island

DURING a short visit to Anticosti Island in August this year it was observed that considerable quantities of *Zostera marina* were washed up on the beach at Ellis Bay. On closer examination it was found that many seeds nearly ripe were present in the material. The conclusion seems warranted that in this area at any rate there are no symptoms of the plant dying off, whatever the cause may have been in other localities¹.

The species is mentioned as occurring on Anticosti Island in Macoun's "Catalogue of Canadian Plants", Part 4, published in 1888; it is also mentioned in Schmitt's "Monographie de l'Île d'Anticosti" published in 1904, as being present in Ellis Bay and several other places on the coast of the island.

J. ADAMS.

Central Experimental Farm,
Ottawa.
Sept. 28.

¹ NATURE, 132, 277, Aug. 19; 483, Sept. 23; 1933.

Characteristic Intervals of English Vowels

IN an experimental research conducted in 1928 in collaboration with H. D. Bouman¹ I was chiefly concerned in verifying by a suitable method of synthesis the frequency values determined by Sir Richard Paget as representing the 'double-resonances' of English vowels. The experimental technique we employed consisted of two oscillating circuits which were put in parallel and produced a compound sound in a loud-speaker.

The chief results we obtained may be summarised as follows:

(1) The 'frequency-couples' determined by Sir Richard Paget produce effectively, when combined in a loud-speaker, quite satisfactory vowels.

(2) The vocal quality depends not only upon a particular combination of two characteristic tones but also implies a definite ratio of their intensities.

I attempted, in 1932, to make a similar study in French vowels. As previously, the starting point of the research were the resonance frequencies of these vowels determined by Sir Richard Paget and published in his book "Human Speech"².

In this research³ some other aspects of the structure of vowels were brought to light. It was shown, for example, that each vowel is founded upon a definite musical interval, that is, that the two resonance frequencies must fall exactly in the harmonic series of tones; an attempt was made, besides, to transpose the characteristic vowel-intervals in different regions of the tonal scale. It

could be demonstrated that all vowels may be 'transposed' for a range of two or one and a half octaves. The ratio of intensities varies, however, with the tonal region.

It seemed worth while, therefore, to test once more the resonances of English vowels in the light of these facts. The experiments which were carried out gave full confirmation of previous results.

In several cases the vocal quality of transposed 'chords' appeared uncertain when appreciated in comparison with natural speech. Yet, as regards 'transposing', it might be argued that the chords thus produced should be compared between themselves and envisaged in the first place as instances of particular 'timbres'.

The following table gives the corresponding interval for each vowel, the normal or resonance frequencies and the lower as well as the higher limit on the tonal scale for which the transposition was made:

/eat/	3 octaves + second	300-2700		350-3150
/it/	2 octaves + sixth	350-2333	326-2173	500-3333
/hay/	2 octaves + third	430-2150	300-1500	600-3000
/men/	2 octaves	500-2000	430-1720	700-2800
/hat/	1 octave + fourth	700-1866	500-1333	1256-3339
/earth/	1 octave + dim.			
	seventh	500-1750	400-1400	1086-3301
/sofa/	1 octave + maj. third	600-1500	326-815	1256-3140
/up/	small seventh	720-1296	600-1080	1256-2260,8
/calm/	diminished seventh	800-1400	600-1050	1256-2148
/not/	major sixth	700-1166	600-1000	1256-2093
/all/	minor sixth	600-960	500-800	1256-2009,6
/who/	seventh	400-750	372-697,5	700-1312,5
/put/	1 octave + fourth	390-1040	326-869	600-1600

The experimental data above stated enable one to draw the following conclusions:

1. The vocal quality bears no relationship to absolute tonal pitch. The 'timbre' of vowels is likely to depend (approximately as that of instruments) upon the ratio of intensities presented by partial tones which occupy in the harmonic series relative but constant positions.

2. Any vowel is primarily characterised by a constant interval between two tones corresponding in natural speech to front and back resonances.

3. The double-resonance theory as worked out by Sir Richard Paget receives a satisfactory corroboration.

P. KUCHARSKI.

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des Sensations du Collège de France,
Paris.

Oct. 11.

¹ H. D. Bouman and P. Kucharski, Synthèses de voyelles au moyen de deux sons simples, *Arch. Neerl. de Phonétique expérimentale*, Tome 4, 1929.

² Sir Richard Paget, "Human Speech", London, 1930.

³ P. Kucharski, Recherches sur la structure des voyelles, *C.R.*, 195, 979; 1932.

The Sycamore Fungus

IN NATURE of September 9, I noted that I had failed in July to find a single spot of *Rhytisma acerinum* on the foliage of sycamores at Corrou in Inverness-shire. Never having hitherto found sycamores free from the characteristic blotches caused by this fungus, I suggested that if *Rhytisma* is disseminated by wind-borne spores, the sycamores at Corrou might owe their escape from infection to the altitude of 1,200-1,400 ft. at which they are growing, besides being far distant from any other woodland.

Since I wrote, however, the fungus has developed on the leaves of a few of these sycamores in September, leaving the problem of the means of its dispersal still unsolved.

HERBERT MAXWELL.

Monreith.