LETTERS TO THE EDITOR.

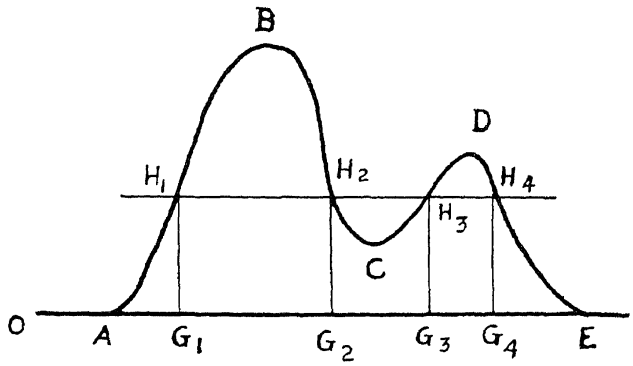
The Fundamental Idea underlying Statistical Tests of Significance.

Suppose an individual has been drawn at random from a known population, but that we are not sure of this. To see whether he could possibly have been drawn from this population we apply a test of significance. This test consists solely in dividing the whole population into two classes A_1 and A_2, such that the number of individuals in A_1 bears to the number in the whole population an arbitrary ratio, P, called the limit for random chance or the limit of significance. If our individual falls in the class A_1, he is not considered significant.

Obviously, this division can be affected in an infinite number of ways; we will have thus an infinite number of tests of significance applicable to the same case. From the point of view of success in the long run each of these tests is as good as any other, provided the same test is used on every relevant occasion. From the practical point of view, however, these tests are not equal and the best test is that based on what may be called the "fundamental idea". Since in a significance test some individuals have to be neglected, the fundamental idea states that the least harm is done by neglecting the least frequent individuals.

We will apply this idea to the following slightly complex case. Suppose the frequency curve is A B C D E, the distinguishing character of the individual being measured along O E.

We now draw H_1 H_4 parallel to OE so that areas $A H_1G_1 + G_2H_2CH_3G_3 + G_4H_4E$ divided by the total area A B C D E is equal to P, our limit for random chance.



Then the class A_1 consists of individuals represented by the intervals AG_1, G_2G_3 and G_4E. H_1G_1, H_2G_2, ... are ordinates through H_1, H_2, ...

It is easy to see that only one test of significance follows from this idea. Although the idea is very simple, it does not appear to be well known. In support of this view it may be stated that Clopper and Pearson in their paper[1] have suggested a test of significance in which an area equal to P/2 is cut off at each tail end of a binomial distribution. Again, when Rhodes suggested in the paper[2] two different tests for the same case, Karl Pearson remarked (page 252)[2] "we can test whether two samples are consubstantial in a variety of ways, is it possible to find a better test—by which I mean a more stringent test—than the 'classic method' of examining the distribution of difference?" If the fundamental idea had been used, this difficulty would not have arisen.

More details will be given in a paper to be sent for publication elsewhere.

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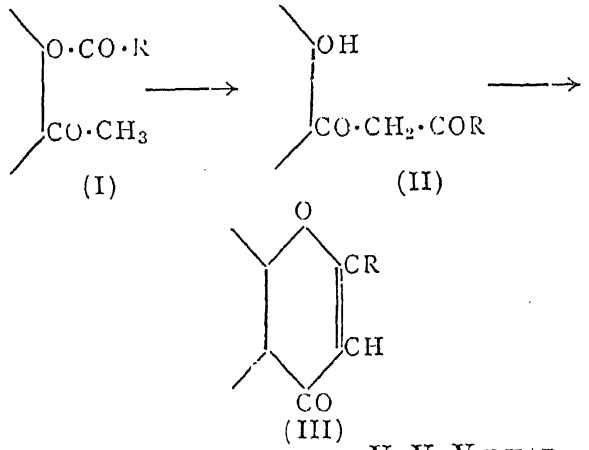
Poona, 5.
September 1, 1938.

[1] Clopper, C. J., and Pearson, E. S., *Biom.*, 1934, **26**, 404–13.
[2] Rhodes, E. C., *ibid.*, **16**, 239–48.

Preparation of Flavones from *o*-Aroyloxyacetophenones.

BAKER[1] showed that *o*-aroyloxyacetophenones (I) rearrange with anhydrous potassium carbonate in presence of benzene or toluene into the corresponding *o*-hydroxydibenzoylmethanes (II) from which flavones (III; R = aryl) may readily be obtained by elimination of water. Mahal and Venkataraman[2] and Bhalla, Mahal and Venkataraman[3] used sodamide in dry ether. It has now been found that satisfactory results can be obtained with finely-divided sodium in ether or toluene; sodamide and sodium have the advantage that no water is liberated when the product, the metallic salt of the dibenzoylmethane, is formed. A number of flavones have thus been prepared by the use of sodium, and the method is being applied with advantage in the synthesis of 2-naphthylchromones (III; R = $C_{10}H_7$) of various types. It has been here found that sodium also produces rearrangement of *o*-acyloxyacetophenones thus providing a synthesis of 2-alkylchromones (III; R = alkyl).



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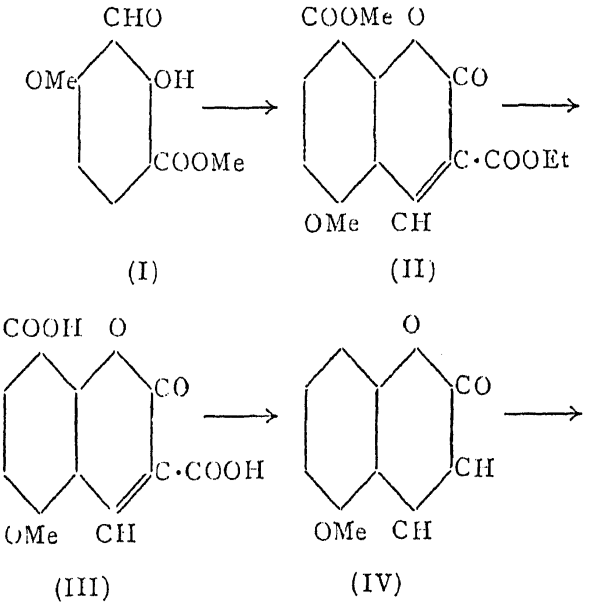
Bombay,
September 3, 1938.

[1] *J.C.S.*, 1933, 1381; 1934, 1953.
[2] *Curr. Sci.*, 1933, **2**, 214; *J.C.S.*, 1934, 1767.
[3] *J.C.S.*, 1935, 868.

Synthesis of 5-Hydroxy Coumarin.

5-Hydroxy-4-methyl coumarins which have been difficultly accessible until recently are now readily available through the condensation of methyl-β-resorcylate and resacetophenone with ethyl acetoacetate in presence of anhydrous $AlCl_3$.[1] The method however cannot be obviously applied for the synthesis of the simple 5-hydroxy coumarin which is hitherto unknown. After some unsuccessful attempts this interesting compound has now been synthesised starting with methyl-β-resorcylate.

The 5-hydroxy coumarin was synthesised as follows:—Methyl 2 : 4-dihydroxy-3-formyl benzoate[2] was methylated to methyl 2-hydroxy-3-formyl-4-methoxy benzoate (I) which on condensation with ethyl malonate afforded ethyl 5-methoxy 8-carbmethoxy coumarin-3-carboxylate (II), m.p. 186–88°. This was hydrolysed to 5-methoxy coumarin-3-8-dicarboxylic acid (III, m.p. 281°) which on decarboxylation afforded the 5-methoxy coumarin (IV, m.p. 85–87°). The 5-methoxy coumarin on demethylation yielded the 5-hydroxy coumarin (V, m.p. 221–23°). The 5-methoxy coumarin afforded the 2,6-dimethoxy cinnamic acid (m.p. 151–53°).



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