In the table a dash indicates that the amount present is less than the sensitivity of the spectrographic method employed, namely, vanadium 0·0005 per cent, chromium 0·0002 per cent, cobalt 0·0002 per cent, nickel 0·0002 per cent. The order in which the rocks are given is the order of their formation.

Plagioclase felspars have also been separated and other minerals are in the process of being separated and analysed.

The microscopic and field evidence indicates that the rocks selected for analysis represent, as closely as can be expected under natural conditions, crystal fractions from a single slowly cooling magma. The amounts of the trace constituents are in this case apparently controlled by the ease with which the trace elements enter the various crystal phases, and we must turn to the crystal chemist for a detailed consideration of the factors involved. The rocks of the Skaergaard Intrusion and the minerals composing them provide data on the kind of changes in the trace constituents which occur as a result of strong fractional crystallization differentiation of basic magma, and this should form a useful starting point in attempts to understand the variation in the trace constituents of rock suites having a more complex petrogenetic history.

Possible practical applications of results such as these include the diagnosis in soils, purely from a geological examination, of deficiencies or excesses, which may be of importance for problems of plant and animal nutrition.

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[1] *Nature*, **155**, 753 (1945).
[2] Wager and Mitchell n. *Mag.*, **26**, 283 (1943).

Economy in Sampling

THE method described by Haldane[1] for estimating the fraction p of population having the attribute A is a particular instance of a more general theory which has been used in this department and elsewhere since 1943.

The statistical methods of assessing trial results in use before the War were for the most part developed in connexion with biological problems, where there is often present a limitation not found in other fields, namely, that the sample size for a proposed experiment must be determined in advance, before the experiment is actually begun. When such a limitation is unnecessary, it is found more efficient usually to plan a statistical *procedure*, and an associated test, for determining the question at issue.

For example, if we want to compare two designs, A and B, of an instrument, with regard to their comparative effectiveness, the classical procedure would suggest A be tried m times and B be tried n times, under similar conditions, and the numbers of successes observed for each design:

	1 Success	2 Failure	3 Total
Design A	a	c	m
Design B	b	d	n
Total	r	s	N

If we assume that, under the given conditions, A has a constant probability of success p_1 and B has constant probability of success p_2, then the null hypothesis $p_1 = p_2$ can be tested by a method which I have developed, or by a method due to Fisher[2], which, on the null hypothesis, associates with the above table a probability $m!n!r!s!/N!a!b!c!d!$. These tests correspond to the procedure in which column 3 of the table is fixed in advance, and columns 1 and 2 are filled in from the experimental results.

We may, however, be able to fix, say, column 2 in advance, and allow the experimental results to determine 1 and 3. In this case, by a procedure exactly analogous to Fisher's, we find that the probability on the null hypothesis associated with the above table is $(m-1)!(n-1)!r!s!/(N-1)!a!b!(c-1)!(d-1)!$, and we can construct a significance test accordingly. For large m and n there is a continuous approximation, which takes the form of the variance ratio function F, analogous to the χ^2 approximation in the classical case. There is also a correction for continuity, analogous to that of Yates[3].

In order to compare the efficiency of this test with that of the classical procedure, we have to compare at the mean sample size, since the actual sample size with the new procedure is not fixed. Consideration of the power for given mean sample size then shows that, when at least one of the two probabilities involved is small, the new test is much more powerful than the classical test. The power-ratio is not fixed, but for suitable values of p_1 and p_2 may increase without limit.

Similar considerations can be applied to all other kinds of statistical test. Broadly speaking, when the statistician was asked by the experimenter the question "How many items should I take for my sample?" it was often difficult to give a reasonable answer, since this would often depend on knowledge which could only become available after the result was known. By making sample size one of the variables which are determined in the course of the experiment itself, it is possible for the statistician to tell the experimenter: "If you follow this procedure, you will determine the issue involved just as soon as your results allow". From a passive role involving static planning and subsequent testing of results obtained, statistical theory acquires an active role, entering into the experimental process itself.

In developing tests for other situations, it is found that the statistical theory involved is closely connected, on one hand with the classical theory of games, as studied by de Moivre[4], Laplace and others, and on the other hand, with the theory of diffusion processes. In particular, the statistical tests involved in many consumer's inspection problems are direct generalizations of the classical problem of the "Ruine des Joueurs", in the qualitative case, while the continuous measurement case corresponds to a linear diffusion problem with fixed absorbent boundaries.

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[2] Fisher, R. A., "Statistical Methods for Research Workers" (Edinburgh: Oliver and Boyd, 1941), 94.
[3] Yates, F., *J. Roy. Stat. Soc.*, Supp. 1, 217 (1934).
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[5] Laplace, A. M. de, "Théorie Analytique des Probabilités" (Paris, 1812).