comparison of the profiles of pyrolytic products, for example, *E. coli* 0115 versus *Shigella boydii* 10 in Fig. 1. These two organisms show almost identical profiles, except for the slight differences of peak height at retention times of products near 10·5 min. Note especially the similarity of the triplet peaks near 17·5 min. Sometimes the only distinguishing feature in typing strains by pyrolysis–gas-liquid chromatography was a slight but significant inversion of peak height ratio, such as shown in the pyrograms of streptococci at retention times between 9 and 11 min. The task of distinguishing between the pattern produced by acid-fast organisms of the Battey strain and *Mycobacterium avium* (so difficult by current methods) was a facile matter (Fig. 1).

The analyses were performed on a Barber Colman model 5000 Series instrument fitted with a pyrolysis module. Bacterial samples were cultured and gathered under consistent conditions; pellets of lyophilized, previously killed, whole bacteria weighing 200–800 μg were pyrolysed in an inert atmosphere on a nickel filament at 850° C for 10 sec; the thermally degraded products were analysed by gas-liquid chromatography. Programmed temperature ranges were from initial temperatures of 20° (sub-ambient) and 50° to maximal 240° C at a linear rate of 12°/min.

Dual column operation was used, and this consisted of coiled copper tubing 0·25 in. outside diameter, 8 ft. long, packed with 15 per cent 'Carbowax 20*M*' coated on 80/90 mesh 'Anakrom *ABS*', and two hydrogen flame ionization detectors. The carrier gas was nitrogen under a pressure of 16 lb./in.^{2}. Range of the recorder was 3×10^{-10} amp at full scale.

To the best of my knowledge, this is the first account of the application of pyrolysis–gas-liquid chromatography to the classification of natural products which are largely macromolecular in character. The findings indicate that pyrolysis of substances of considerable complexity can form a new basis of taxonomy in the biological disciplines. Where problems of differentiation or identity of complex cellular material are encountered, pyrolysis–gas-liquid chromatography should prove to be a very useful adjunct to present techniques.

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Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or by the U.S. Department of Health, Education and Welfare.

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AGRICULTURE

Varietal Differences in Wheat Quality

Quality-testing of material from the bread-wheat breeding programme at this Institute has provided the opportunity of seeing a very wide range of wheat types. This has proved valuable in the recognition and investigation of individual factors which influence both the physical dough properties and baking characteristics of flours milled from these wheats.

The results obtained during routine quality testing by means of the baking test and the Chopin Alveograph showed that the flour from these wheats fell into three broad general types: (*a*) soft, low-absorption flours which produced extensible doughs of low to medium strength and test-loaves of fair to good volume but with a pale, brittle crust and weak crumb texture; (*b*) hard, medium to high absorption flours which produced extensible to well-balanced doughs of good to excellent strength and test-loaves of good to excellent volume with characteristically strong crust and fine, strong crumb texture; (*c*) hard, granular flours with high to very high absorption, most of which produced overstable or 'tough' doughs of good to excellent strength but which slackened appreciably during fermentation and gave loaves of poor volume with strong 'leathery' crust and coarse, unattractive crumb texture.

An explanation of the vast differences in both baking and physical dough characteristics of flours from these wheats has been sought in separate studies of their protein and starch contents. Extensive trials, in which freshly washed gluten from a wide range of flour types was superimposed on low protein samples of flours from each of the three types, have shown that, provided the flours from which the glutens were extracted were mature as judged by their test-bake performance, then all glutens behaved similarly, irrespective of their source. The different behaviour of glutens from those flours which have a high bromate requirement and those in the group of strong 'overstable' flours characteristic of several Australian wheat varieties can be overcome simply by oxidation or reduction respectively in the doughs from which they are washed.

These experiments also showed that the type of Alveograph curve and test-loaf produced by these blends was determined by the type of low-protein base flour used.

Earlier work in this laboratory[1] had shown that the Alveograph curve and test-loaf characteristics of experimentally milled flours were strongly influenced by the level of damaged starch which they contained. In the present study it has been found that by increasing the level of damaged starch in the lower-strength flours milled from soft wheats, they can be changed readily to give Alveograph curves and test-loaf characteristics typical of those obtained from good quality strong wheats.

The above observations indicate that flour constituents other than gluten and starch do not have any significant bearing on the flour characteristics measured by the Alveograph and test-bake. This has been checked by extending the study to synthetic doughs consisting of prime starch and freshly washed gluten. It has been found that a range of normal type Alveograph curves and test-loaves can be produced simply by varying the maturity of the gluten and the proportion of damaged starch used in these synthetic doughs.

It will be seen that the type of Alveograph curve and test-loaf for a flour from any variety of wheat and of any given protein content is determined by the level of its starch damage and the maturity of its gluten. Provided flours from which glutens are washed have comparable maturity, as judged by their test-bake performance, then all glutens, irrespective of their source, give the same result when superimposed on an Alveograph or test-bake dough.

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