their landing and take-off problems a new aerodynamics, the extension of which into the unsteady 'gust case' was exemplified by an exciting experiment in which balsa-wood models were catapulted across a 24-ft. wide jet of air and their response in roll and yaw recorded by ciné-camera.

Another flourishing research school is in physics and chemistry of materials. The physical mechanisms of metal fatigue, including the details of crack development under cyclic loading, are now, in the main, scientifically determined, and are being rapidly related to the fatigue-life estimation of aircraft structures, showing, as one surprising result, that increase of temperature can sometimes extend fatigue life, because crack propagation in each cycle may halt sooner if plastic working is facilitated. Research on new materials has uncovered some impressive carbons with good strength and zero permeability, some new methods of construction in plastics reinforced with fibre-glass to give a strength-to-weight ratio 2.4 times better than 100 tons/in.² steel, and a range of promising organic syntheses aimed at lubricants and polymers with improved high-temperature stability.

In the electronic field, an important new method of determination of the effective mass of charge carriers in semi-conductors was demonstrated, using observations of Faraday rotation, which was also shown modulating a beam of infra-red radiation at audio-frequencies. Promising circuits were exhibited, aimed at using semi-conductors to convert variable-frequency power from an aircraft's alternators to constant frequency. Research on aerials included the study of logarithmic-spiral forms at microwave frequencies, and some elegant work on corona breakdown on aircraft aerials at altitude. In the electronic equipment field, the miniaturized telemetry equipment, for transmitting pressures and other data to ground during weapon trials, stood out particularly.

Servocontrol is a well-known Farnborough activity. In the manned-aircraft field, it was interesting to see an aircraft being flown with all-electric signalling between the pilot's stick and the control surfaces.

This is being used to facilitate a range of manoeuvre demands. In the rocket field, the control of *Black Knight* by the swivelling of its two motors was demonstrated, together with equipment for stabilizing the attitude in space of the upper-atmosphere-research rocket *Skylark*. Equipment for studying the possible gyro-stabilization of a communications satellite so that its aerials will always point towards the centre of the Earth was also exhibited.

Research aimed at navigation and guidance was shown in impressive volume and quality. The propagation of very-low-frequency waves (of length around 20 km.) is now known to have remarkable stability as far as the antipodes even during magnetic storms, and research in a *Comet* aircraft flying from Farnborough has given good reasons to expect development of an airborne system for world-wide position determination within an error of at most 5 km. using only six ground transmitters. Inertial navigation has also been making extraordinarily rapid progress, with the Royal Aircraft Establishment again active, its longer-term researches being aimed, it appears, mainly at reduction in costs. Other titbits in this field were a tantalizing star-tracking demonstration and a glimpse of the future for high-speed computers in air traffic control.

It would be impossible to do justice to this huge exhibition in a short article, although a brief mention of the fascinating stands relating to water-drop or ice-crystal impact on aircraft, to new wind-tunnel techniques for aeroelastic research, and to rocket techniques for aerodynamic research at very high speeds, can scarcely be resisted. The days ended with experimental flying displays, showing among other things how the British army of the future may receive its supplies without parachutes, by low-level drops of equipment on special shock-absorbing skids, and how flight research is adding to our knowledge of the physical characteristics, and the effects on aircraft, of atmospheric turbulence.

Mr. M. J. Lighthill and his staff at Farnborough can be warmly congratulated, both on the story that they have had to tell and on the manner of its telling.

PETER SANDERSON

BRITISH BAKING INDUSTRIES RESEARCH ASSOCIATION

NEW LABORATORY WING

A NEW laboratory wing at the Baking Industries Research Station, Chorleywood, was opened on April 27 by Mr. Trevor Bowen, honorary president of Bakers of Kensington, and a former master of the Worshipful Company of Bakers.

In declaring the new north wing open, Mr. Trevor Bowen recalled the early days of the Research Association in 1947, when it had few members and a staff of only three, and, to indicate his appreciation of the services rendered by the Research Association, Mr. Bowen made a most generous gift of one thousand guineas as a contribution towards research.

The facilities of the new wing have been made essential by the growth in the Association's membership and activities. The work of the Association has outgrown the extra accommodation made available in 1951, when the present west wing was opened, and the need for additional and improved facilities has been a pressing one for some time.

The new accommodation consists of a two-storey wing running northwards from, and linked to, the original building of Chorleywood Lodge, designed to blend with the existing buildings and erected at a cost of approximately £40,000, including equipment.

The main feature of the ground-floor is the pilot-scale biscuit bakery and its associated laboratory. New pieces of equipment, built specially by members of the Research Association, are a model forced convection travelling oven by the Spooner Food Machinery Engineering Co., Ltd., and a De Vuurslag rotary biscuit cutter supplied by John Pelkman Engineering Co., Ltd. The biscuit section will thus have, virtually, a model biscuit plant which will enable the whole range of hard- and soft-dough biscuits to be studied. It is expected that this will enable previous work to be expanded on such problems of biscuit production as checking, or spontaneous cracking, in biscuits, on changes in biscuit dimensions

in baking, and on the effect of various factors such as fat composition and storage conditions on the development of fat bloom on biscuits. The new equipment should also greatly facilitate the testing of biscuit flours and the development of standard procedures for this purpose. Sectioning and staining procedures have enabled a technique to be devised for investigating the starch, protein and fat distribution in biscuits and these investigations will be continued.

A new and well-equipped laboratory has been provided for the Organic Chemistry Section. This will give much-improved facilities for the work which has been in progress for some years on flour lipids, which is substantially supported by a grant from the United States Department of Agriculture. The work on lipids represents one facet of the attack on the problem of why flours differ in baking quality. Its immediate aims are to establish whether wheats of different varieties grown under identical conditions differ in lipid content, the influence, if any, of seasonal or environmental factors on the lipid composition of a single wheat variety and, finally, whether the lipid content or composition of a flour may be correlated with its baking properties. Also being studied are the fatty acid distribution in flour lipids, and methods for the separation of flour lipids in undegraded form.

These investigations, together with others in progress at the Research Station, will be greatly facilitated by the Buhler mill, which forms part of the equipment of the new Cereals Research Laboratory. This mill will provide much-needed facilities for milling wheat varieties on the site in connexion with the lipid project and other investigations, such as that of protein fractions being carried out in the new Physical Chemistry Laboratory. These provide another aspect of the problem of baking quality. Proteins of the gluten complex are being studied in the hope of establishing why wheats of similar protein content differ so markedly in this respect, and the work ultimately may lead to an understanding of the vast superiority of wheat protein over other cereal protein for bread-making. The present emphasis is on separation of gluten into its constituent proteins using starch-gel electrophoresis.

Also in the Physical Chemistry Laboratory are located the investigations into bread staling at present being pursued. These are concerned with those properties of wheat starch which influence the

hardening of bread during the staling process with particular emphasis on the role of anti-staling agents. These agents increase the initial softness of bread and reduce the rate at which it hardens on ageing. Investigations of the interaction of anti-staling agents and starch are in progress in order to elucidate the basic mechanism of these effects.

An instrument and balance room has been provided on the first floor to house the more elaborate equipment used by all sections on different occasions.

At the southern end of the first floor the new Microbiology Laboratory extends the width of the building. There are a separate room for sterilization and another with filtered air-intake suitable for sterile techniques. The laboratory is concerned with all aspects of the microbiological deterioration of baked goods, but at present the work is mainly concerned with factors affecting mould growth in baked products, such as the effect of humidity, sugar concentration, and the degree of acidity or alkalinity of the mix. The use of mould inhibitors, such as propionic acid and its salts, as ingredients in bread and cake is also being studied. It is expected that legislation will shortly be passed to allow the use of these compounds, and the most effective ways of employing them and of overcoming side-effects, such as a reduction in bread volume, are being worked out.

Further facilities in the north wing are a combined office and laboratory for the Deputy-Director of Research, and another for the head of the Member Services Division, who is also responsible for applied research projects.

There is also office accommodation for two members of the newly formed Scientific Liaison Service set up to complement the work of the Industrial Liaison Service, which is staffed by trained bakers. The purpose of this Scientific Liaison Service (at present staffed by a chemist and an engineer) is to promote the application of the results of scientific research in the baking industry and to assess those problems in industry which require some research for their solution. These objectives are being attained primarily by personal visits and discussion, but also by lectures, demonstrations and collaborative experiments. A mobile laboratory has been equipped to take scientific apparatus to members' bakeries and has already proved its worth.

G. A. H. ELTON

STEREOCHEMISTRY OF NATURAL PHENOLIC COMPOUNDS

THE aim of the Plant Phenolics Group symposium, held at the University of Bristol on December 16, was to discuss recent developments and current problems concerning the stereochemistry of natural phenols against the background of available methods for determining the stereochemistry of molecules.

Dr. B. R. Brown (University of Oxford) dealt with the determination of relative stereochemistry.

The methods available for the determination of relative stereochemistry were illustrated by reference to the conformationally rigid, steroidal diol system (I) and to the conformationally non-rigid flavan-3,4-diol system (II). Infra-red measurements of C—O stretching frequencies enable reliable conclusions to be reached about the stereochemistry of the 3-hydroxyl group in (I) but not about the hydroxyl

groups in (II), because of interference from aromatic vibration frequencies. Similarly, infra-red studies of hydrogen-bonding in (I) lead to reliable conclusions, but those from (II) do not, because of the conformational lability of the system. Ring formation to give carbonates or isopropylidene derivatives is diagnostic with (I) but not with (II), the *cis* and *trans* isomers of which both form cyclic compounds. In view of this, measurements of the rates of cleavage of flavan-3,4-diols with lead tetraacetate is in progress, a method which enables the *cis* and *trans* isomers of cyclohexane and other cyclic 1,2-diols to be differentiated. The method of molecular rotation differences has been applied with success to the steroids (Barton) and to the catechins (Freudenberg) and more recently by