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INSTITUTE OF CHEMISTRY

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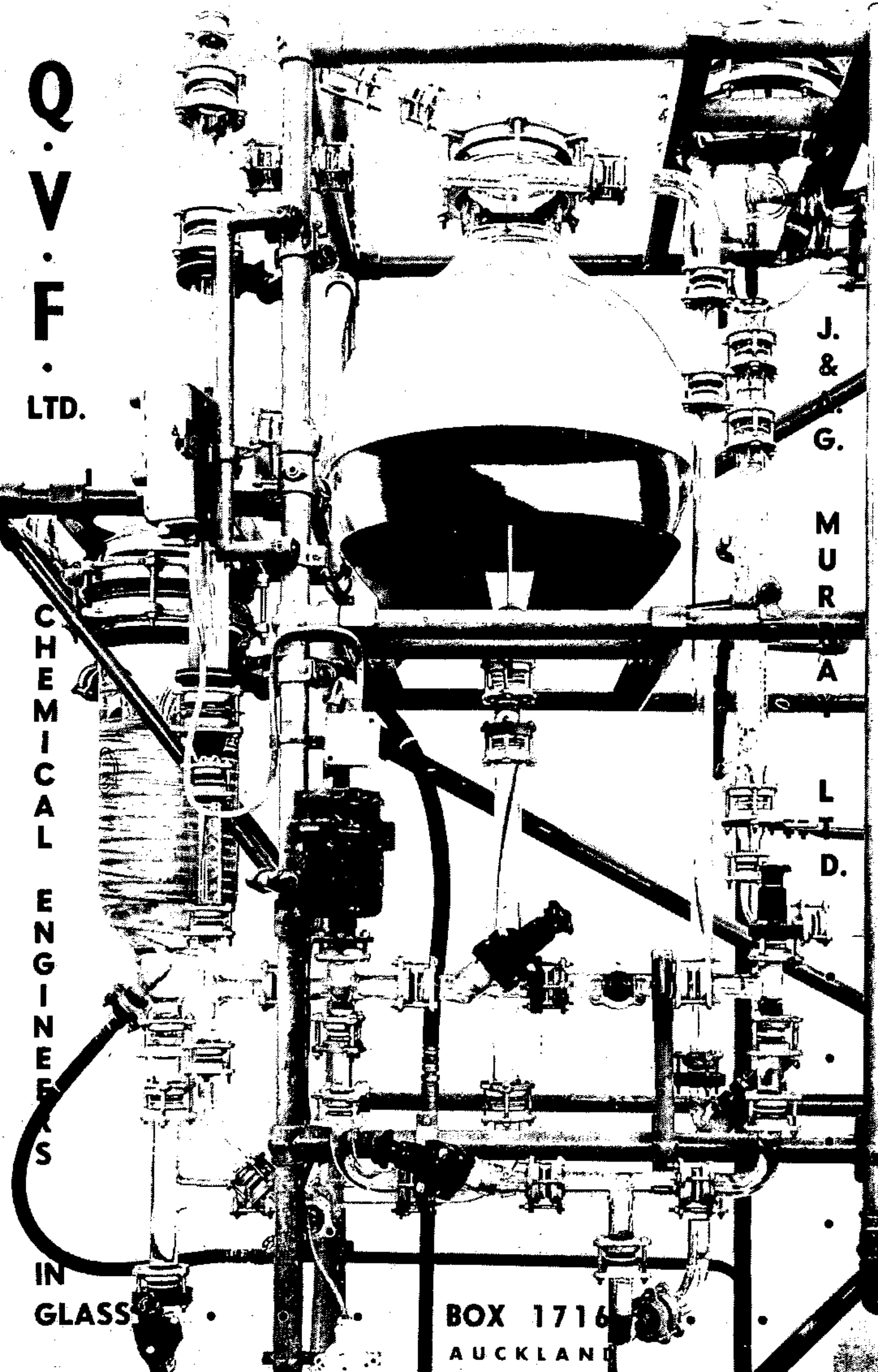
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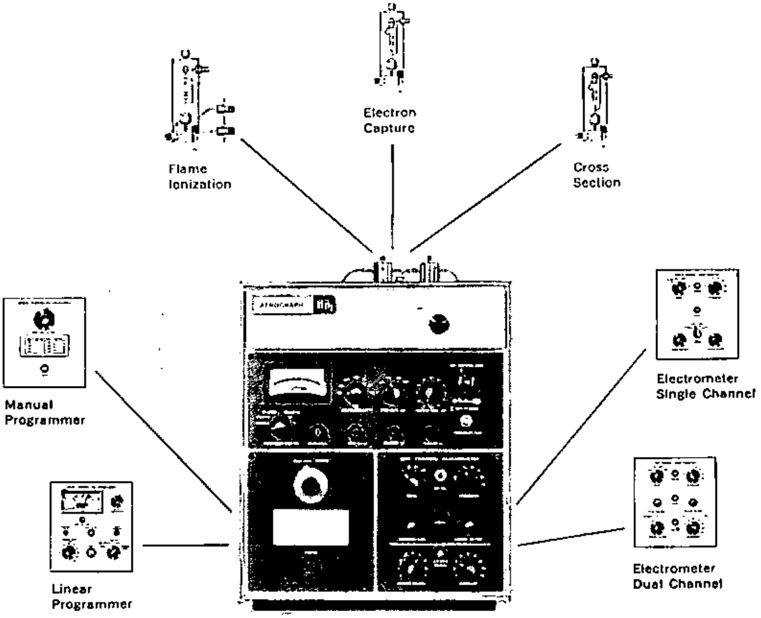

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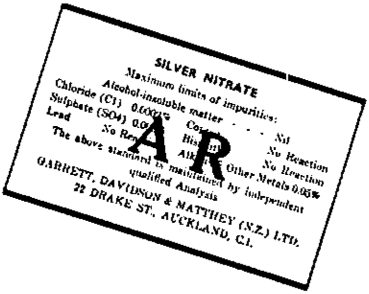
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SPELLING MISTEAKS

One of the Editorial priveledges is to act as an adjudicater for the Chemical Essay Prize. The first time we tackeled this chaw we gleefully crost out spelling errers as an obvius way of marking down, but soon we were faced with the problem of desiding between misspelling and missprints (altho these are about equally culpible under the Rules). Eventuly we became resined to shaky spelling in a fair proportion of the entrys. Last year we saw at one of the universities a list of speling errors culled from the chemistry examination ansers. It was a very long list and the enginewity shown in some variants of common and tecknical words promises that future Chemical Essay entrants will maintain passed standards.

Despite a developping tolerince we are still somewhat shocked when a writer on a subject related to mineralogy consistently misspells the name of an oar with which he has been working. There was another, from an industry which processes flower, who wrote (and note that here we are quoting exactly) "kneed the dough". All we can hope is that, if he kneaded the prize money that badly, he washed his nees before using them as described. At least he was good enuff to append the silent "ugh" after "do", rather than an "e" or an "h", and so give some indication that he was employing his patella for purposes other than venery or coral singing. *Doh — a female deer,* sing the Trapp Family.

In practice, how much does it matter? The mistakes in spelling in the preceding two paragraphs were made with a purpose — to see how the sense was affected. Rather sadly we admit that, in context, the errors have not produced any real ambiguity, even though "oars" and "flowers" may have appeared a little puzzling at first sight. But after all, most of these laboured mistakes take the form of phony phonetics or confusion of phononyms. Spoken, most of them would have passed undetected by the New Zealand ear; and they do not pretend to the genius for distortion shown by the true bad speller.

"Distortion" reminds us that English orthography itself enshrines many mistakes. During the crystallization of modern spelling out of the polyglot left from the Norman conquest, unphonetic forms were often retained to indicate derivation. This provides an etymological tracer technique which can sometimes reveal, or add significance to, the accepted meaning — for those trained to such interpretation; but occasionally the derivation was mistaken and the modern orthography is itself a distortion of the original word.

If incorrect spelling does not seriously impair meaning, and the uses of etymological forms are limited and sometimes misleading, is an insistence on correct spelling no more than pedantic conservatism? It is dangerously easy to say yes and to conclude that words should be spelt as they are pronounced. But pronounced by whom? We can imagine issuing invitations to some friends to a *dahnse*, to others (especially the Australians) to a *dannse*, and even, for one or two, to a *darnse*. The only widely-applied advances to a phonetic spelling reform appear to be the changes sanctioned in the U.S.A. and these have mainly amounted to eliminating "silent" letters, generally consonants. The more labile vowels are less easily handled. Yet, although American text-books happily write "sulfur", "fosfate" seems rare and we have not encountered any "fenyl" compounds.

This brings us to the question of changing pronunciation, a major factor in the present difference between sound and spelling of many common words. The process continues (perhaps a little more slowly because accepted spellings exist) so that a spelling readjusted to an agreed pronunciation would soon be out of date. Standardization itself cannot arrest the changes inevitable in a living language under the influence of factors as diverse as laziness, contact with other communities and social prejudice.

After starting this article by deploring spelling mistakes, we have nearly produced an apology for them. It is time to nail our colours (colors) to the masthead.

First, let us recognize that there are some who have a very real difficulty with spelling. Everyone has problem words but for some there appears to be a psychological block in the spelling mechanism — perhaps they were frightened by a spelling-bee in early school days. From these we must accept bad spelling in occasional papers (letters, perhaps, and examinations) but in considered reports, especially if intended for publication, they should recognize their deficiency and adopt the obvious remedies of consultation and independent checking. They should not leave it to editors, for even editors may nod. Undoubtedly, examples can be quoted from the pages of this *Journal* over recent years, but we prefer to cite the *New Zealand Listener* for March 26. In a description of "The Chem. Lab. Mystery" is the sentence, "The third-formers were sucking their pippets". "Pipets" we accept in American publications, but we deplore third-form moppets (mopettes?) larking in the lab. (The pipit is near enough to a lark for our purposes.) The reasons for such comment on this quotation are that it is fairly obviously a writer's mistake and not a compositor's; it has escaped the editing and correcting processes; and it could just as well be a spelling mistake for the bird as for the measuring instrument, although perhaps not in this context.

Secondly, we contend that even if a good case can be made for revision of spelling this is no excuse for conscious, careless or ignorant departures from current accepted spelling. Revision should be through a regulated process of scholarship, not through secession to the anarchy of the linguistically lazy or illiterate. In particular, complaint ill becomes the chemist who snorts with contumely when *his* conventions are contravened by the layman. Chemical formulae can be more than a shorthand spelling for the name of a compound but frequently they are not, and for the non-chemist this is their common purpose. Hence PH or H2S, and even Cl402, however much they offend the specialist, are no worse than spelling errors. In fact, C6H6 is in most contexts a more venial mistake than "benzine". Do our members employed in a great oil company shudder at their firm's advertisement with METHYL BENZINE in three inch letters under an atomic model of methylbenzene?

If the chemist would not agree to the revision of chemical symbols and terms on a basis of wrong use by people ignorant of their full significance, he should not condone changes in spelling arising in a similar way. If orthography is to be varied let it be an act of reconstruction, not of vandalism. Meanwhile we accept the rules and exceptions as they stand, prepared to thumb the dictionary when in doubt, and to submit our composition to the scrutiny of friends, in the hope that their blind spots are not coincident with ours.

PROBLEMS IN SILAGE INVESTIGATIONS*

R. J. LANCASTER
Ruakura Agricultural Research Centre, Hamilton

The object of silage work at Ruakura is to find the most efficient method of conserving grass as silage. This embraces the whole range of factors from the cost of making and storing silage to the production value of the material eaten by the animal. On the cost side, there are already extreme cases in New Zealand. On one privately-owned farm, over £8,000 has been spent on storage facilities plus auxiliary equipment. Is the fodder conserved any more economically by this system than by the current "cocky" method of making a heap of grass and feeding what remains at a later date in the form of silage? It is not an immediate purpose at Ruakura to answer this question, but it serves to underline the important point that cost must be considered in making practical recommendations to the industry.

From the agricultural point of view, efficiency of conservation is concerned with three main issues: (1) Loss of nutrients; (2) Acceptability; and (3) Nutritive value.

NUTRITIVE VALUE

The order of importance of these factors is the order stated, since nutrients lost are useless and nutrients saved are useful only if accepted by the animal. The nutritive value of silage depends mainly on the kind of herbage ensiled and on its maturity. This has been widely studied abroad, and will not be considered further here.

ACCEPTABILITY

Acceptability is far more important, but little studied. It has been established that cattle eat less the more mature the material. Also, the drier the silage the higher the intake. There is as yet no evidence to determine whether this is mainly a matter of water content, or whether some related factor is involved. It has long been known that more satisfactory fermentations are obtained with drier material, and it is likely that acceptability is more dependent on specific fermentation products than on water *per se*. This is one reason why silage fermentation studies form an important part of the Ruakura project.

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* *This article is based on the address given last year by Mr Lancaster as Chairman of the Waikato Branch.*

NUTRIENT LOSSES

Nutrient losses can be ascribed to several causes. The most obvious is weathering — the penetration of air and water — which accounts for 20 to 40% according to the size and geometry of the stack. Effluent of juices in the ensiled material can account for a further 15%. Finally, inefficient fermentation may account for substantial losses.

WEATHERING

Agriculturally, weathering is the most important source of loss, and the most easily eliminated. Its presence is obvious to any farmer, but its extent is ignored or not known. The writer has regarded work on this problem as rather a mundane chore, but it has assumed considerable importance from the farmer's point of view. The advent of polythene film has provided a cheap and easy method of eliminating weathering losses. To sell the technique to farmers, it has been necessary to set up "demonstration experiments" and to undertake a large field project in which losses under various systems of covering are measured. Obviously, there is little point in advocating experiments aimed at improving fermentation so long as 85% of the farmers do not even cover their silage.

ARTEFACT LOSS

It is of interest to draw attention to one source of loss due to the failing of the chemist. It has long been the practice to measure dry matter in silage by some oven-drying technique. Sometimes, corrections have been made for loss of volatile matter from silage, but no satisfactory procedure was used until the recent work at Edinburgh was published (1). A modified form of the Dean-Stark toluene distillation for water was proposed. Volatile matter from silage is collected in the distillate and, being mostly acidic, can be titrated and corrected for. The apparatus has been further improved at Ruakura (2) and at last a fairly precise method for measuring water is available — hence dry matter in silage. It has been shown that a bias of up to 20% can occur in the dry matter estimate if volatile materials are ignored. Since most of these are important sources of energy to the ruminant, this is an error which could not be tolerated.

SILAGE FERMENTATION

Studies on silage fermentation are justified by the belief that nutrient losses are lower, and acceptability to the animal is higher, the better the quality of the silage — "belief", because there is very scanty evidence available. Oddly enough, quality of silage appears to have been defined more in terms of acceptability by the human than by the bovine animal. It turns out that the more acceptable silages have low pH values (3.5 to 4.0), and fermentation control is directed toward achieving this end. Whether this is agriculturally sound remains to be proved. The first step toward proof is to learn to control the silage fermentation so that material may be tailored for testing with animals. Most people involved in silage research are still taking this first step.

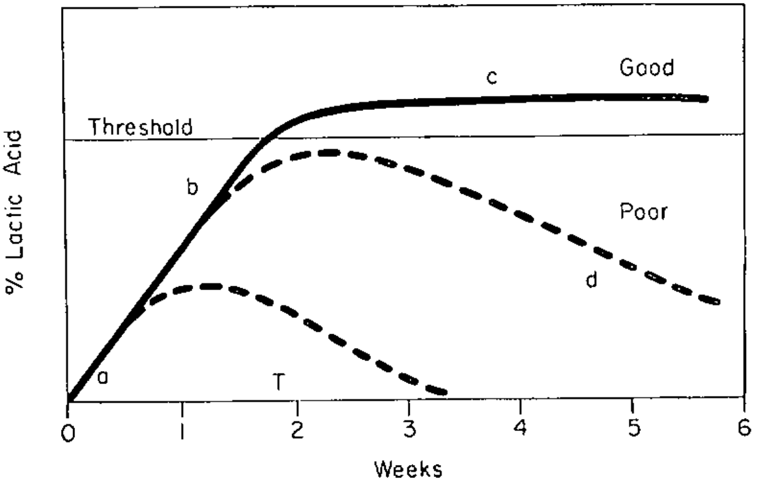

FIG. 1: *Hypothetical fermentation model.*

A fermentation model which provides a series of testable hypotheses will be considered. Conversion of carbohydrate to lactate by appropriate bacteria commences within hours of ensiling suitable material. The resulting pH lowering continues until a value of 4 is reached when biological activity ceases and a stable silage is achieved. The lactate concentration time curve is shown as *a b c* (Fig. 1). However, if at time *T* some threshold concentration of lactate has not been reached a secondary fermentation which has been concurrently developing is able to dominate the situation. As a result, lactate is degraded and butyrate develops. The resulting pH rise favours conditions for further degradation and a chemically unstable silage results. In this instance, the lactate curve *a b d* is followed.

The variables in this system are:
(1) Level of threshold.
(2) Concentration of available carbohydrates.
(3) Initial microbial population.
(4) Speed of primary fermentation (*a b* in Fig. 1).

Conditions which favour a chemically stable silage are a lactate threshold that can be reached by fermenting the available carbohydrate; and a sufficiently rapid fermentation to cross the threshold before time T is reached.

Microbial population: Fresh grass carries a widely-varied microbial population which usually contains only a very small proportion of lactate-forming bacteria. In all Ruakura silage studies and all relevant material examined, it appears that, no matter how "bad" the final silage, some lactic acid was always formed in the initial stages. This could be explained in terms of weak strains of bacteria, or insufficient of them, but usually where the evidence is available some other part of the system in the fermentation model can be invoked to explain what happened.

Level of lactate threshold: That a pH of 4 or thereabouts is generally required for a stable silage has been known at least since Virtanen's work in 1926, and the buffering capacity of grass has also long been known. It is obvious that the level of the lactate threshold will be a function of grass buffer capacity, hence the extent of variability and cause of variation of this factor is of great interest. By titrating grass slurries to pH 4, McDonald (3) has shown that a range of 2.2 to 6.6% lactic acid (on grass dry matter) is required to reach pH 4. However, this measurement is insufficient to define the lactate threshold since the fermentation alters the buffer system as shown in Table 1.

A second factor operates to modify the threshold level — the water content of the ensiled material. That certain bacteria have specific salt tolerance ranges is well known

TABLE 1: Buffer Capacity of Grass and Lactic Acid in Silage

Grasses		*Silages*	
Sugars % D.M.	*Buffering Capacity % D.M.**	*Lactic Acid % D.M.*	*pH*
15.1	3.1	8.7	3.8
16.1	3.7	10.4	4.3
17.0	3.0	11.5	3.7
16.2	4.4	11.5	4.1
19.5	4.0	17.9	4.0

* Gram lactic acid to bring extract of 100 g grass dry matter to pH4. McDonald and Henderson (3).

and this appears to apply to the silage system. Wieringa (4) in theoretical studies has shown that lactobacilli can withstand higher salt concentrations than the butyrate formers. This is the probable theoretical explanation of the well known fact that in wilted silages pH values as high as 5 are regarded as satisfactory. The significance of water as a determinant of the lactate threshold in the model also follows.

At Ruakura, experiments to demonstrate this threshold hypothesis as applied to water concentrations have so far proved unsuccessful. Stable conditions have been achieved at pH 5.4 in material of 50% D.M. but this proves nothing. At this moisture level pH may have no influence on the situation. It is possible that in the silage system a combination of osmotic pressure and hydrogen ion concentration are partly additive at high moisture levels, but that as moisture is removed the osmotic effect is dominant.

Sugar Content: At present, it is assumed that carbohydrate is the sole source of lactate. If so, it is obvious that sufficient carbohydrate must be present to enable the lactate threshold of a particular system to be reached. The data of Lanigan (5) serve to illustrate this (Fig. 2). This is a study of molasses as silage additive. In no case is the theoretical concept of the threshold exactly reproduced here; but the data suggest a more diffuse threshold than proposed in the model.

That sugar content of ensiled herbage is of prime importance in silage-making is generally accepted. The factors determining sugar levels in herbage therefore require

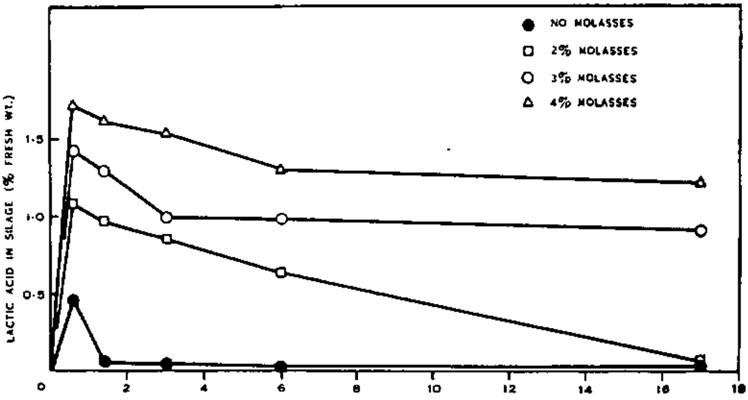

FIG. 2: *Changes in lactic acid at various levels of sugars.*

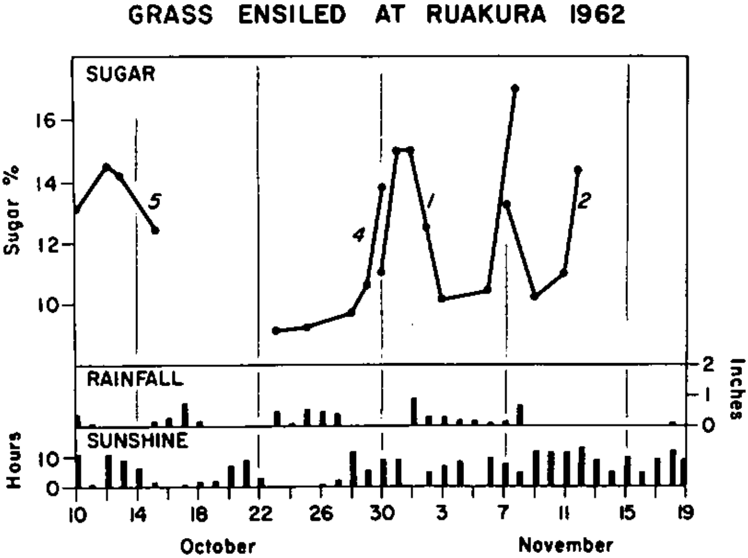

FIG. 3: *Mean sugar concentrations of grass ensiled.*

study. Three such factors may be considered, species, maturity at harvest and weather. The farmer has some control over the species of herbage in his pasture sward and of the stage of maturity at cutting. He has little control over the weather but nevertheless this has been shown to exercise great influence on the water soluble sugar content of pasture herbage.

Melvin and Sutherland (6) have shown a 30% decrease in sugar content by shading pastures. Figure 3 shows the mean sugar concentration each day on which grass was ensiled on separate Ruakura dairy farm units in the 1962 season. The numbers of the curves refer to the individual dairies. The rainfall and sunshine data are presented in the same diagram. The great fluctuations in sugar concentrations are to be noted, as well as the distinct relation between the weather sequence and the changes in sugar concentrations. Under field conditions, it is considered that about 15% sugar (in grass D.M.) is necessary to form a stable silage. Needless to say, practically all the silage made this year at Ruakura was "poor".

Aeration: A further factor which determines the amount of sugar available for fermentation is the aeration which occurs after ensiling. Limited aeration and heating was at one time regarded as essential in ensuring the desirable fermentation. The threshold hypothesis does not support this view. Rather does it seem that removal of sugar by

TABLE 2: Effect of Aeration on Silage Production

	O_2 Absorbed (Litres)	*Sugar % D.M.*	*Water*	*pH*	*Lactic Acid % D.M.*
Grass	—	16.0	81.6	—	—
Silage	0	9.5	81.6	4.45	8.36
	3	7.8	82.1	4.57	7.42
	17	5.1	83.9	5.09	3.40
	23	4.2	85.3	5.39	2.56
	28	2.1	85.7	6.02	0.00

continued respiration could reduce potential lactic acid production below the threshold level.

Laboratory experiments are being conducted at Ruakura to test this hypothesis, but results have mainly proved inconclusive. However, the data shown in Table 2 leave little doubt as to the detrimental effects of aeration. It can be seen that under aeration, sugar is decreased, water increased and lactic acid decreased, all undesirable features in a silage fermentation.

CONCLUSION

Although an enormous amount of experimental effort has been expended on silage making studies, much conflicting data have appeared in the literature. This might be ascribed to two main causes. First, the use of unsatisfactory test material for ensiling; second, the practice of relating only the finished silage to the material ensiled or to the treatment imposed.

Consideration of the test material is important. If the hypothesis to be tested supposes a treatment will improve the silage, one would not expect a significant result by ensiling herbage potentially capable of yielding technically perfect silage. The converse case also holds.

Data from finished silage are of limited value since they are merely points on time curves. Since time is one of the important variables determining silage quality, particularly in short-term experiments, the interpretation of data from finished silages alone is very difficult.

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CHEMISTRY DIVISION, D.S.I.R.*

On April 1, 1964, the Dominion Laboratory became Chemistry Division, D.S.I.R. The "Colonial Laboratory" was established at Wellington in 1865 as part of the Mines Department to analyse New Zealand minerals. In 1905, the Laboratory was removed to a site in Sydney Street, and in 1907, when New Zealand became a Dominion, was renamed the "Dominion Laboratory". In 1909, the Laboratory became part of the Department of Internal Affairs.

The work of the Laboratory increased rapidly as Government Departments, particularly the Department of Health, realized the importance of chemical techniques; and in 1924, 1925, and 1927, branch laboratories were opened in Auckland, Christchurch and Dunedin. Temporary field laboratories have been established at various times to support special investigations, and at present such a laboratory is operating at Wairakei to carry out work on geothermal energy. In 1926, the administration of the laboratory was transferred to the newly-formed Department of Scientific and Industrial Research.

The Laboratory occupied new premises at Gracefield in 1961. The staff now numbers 158, of whom 64 are professional chemists or chemical engineers.

Dominion Laboratory is the largest chemical laboratory in New Zealand, and is of a size that permits considerable staff specialization. By using teams of collaborating specialists it is thus possible to undertake chemical research not practicable in smaller laboratories.

The Laboratory has four main functions:

(1) To carry out long-term research, mainly in fields of economic value to New Zealand, so that knowledge for future technological development will be available when needed.

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* It is proposed to publish in the *Journal* a series of articles summarizing the functions and achievements of New Zealand chemical laboratories. The Dominion Laboratory, as the largest and oldest of these laboratories and the mother of many of the others, was obviously the first choice for this series. The occasion is the more appropriate because the title which this laboratory has borne for 57 of its 99 years has this month changed to the more exact, if less nostalgically romantic, "Chemistry Division, D.S.I.R.".

This account of the work of the Chemistry Division has been prepared by Mr G. Chamberlain and the Director, Dr I. K. Walker, from material supplied by officers in charge of the Sections.

(2) To carry out chosen investigations to raise the efficiency of New Zealand industry, both private and Government, and to promote new industries.

(3) To serve as a central laboratory for the chemical, metallurgical, and chemical engineering needs of Government Departments and other branches of D.S.I.R. until their needs in these fields justify specialized facilities of their own.

(4) To promote the launching and growth of research associations and other laboratories able to give a detailed service to industry.

Research is undertaken to promote the economic exploitation of New Zealand resources, and to develop new scientific techniques applicable to the study of local problems. Research of this type has assisted the development of the pozzolan, clay, perlite, cement, and limestone industries. Other and more diverse applications of this type of research include studies of corrosion in topdressing aircraft to assist the aerial topdressing industry; research on spontaneous combustion in wool to prevent shipboard and wool store fires; investigation of alkali-aggregate reactions in concrete to promote sound construction of hydro-electric dams; studies of drying techniques to assist the tobacco industry; investigation of spray residues on fruit to assist the fruit growers; chemical engineering, corrosion, and geochemical studies to aid the economic development of geothermal steam power. During the past ten years, over 300 papers have appeared in scientific journals detailing the results of research work of economic value to New Zealand.

Research policy is aimed at combining basic chemical research with investigation of problems of economic importance. For example, some projects involve the exploration of a specific field of chemistry such as X-ray crystallography or nuclear magnetic resonance by a group of specialists, so that these techniques can be applied to problems of economic significance to New Zealand. The techniques are also available to other organizations for research purposes. In this way, Dominion Laboratory collaborates with scientists in other laboratories and in universities. The research work currently in progress in the Laboratory is listed under the various section headings.

Some of the research fields which the Laboratory has fostered grow to a size where it becomes desirable that separate laboratories with specific terms of reference be established to deal with them. In this way, independent laboratories are established and nurtured during their early growth to conduct research in specific fields, such as clay technology, meat, wool, and isotope chemistry. As each of these new laboratories is established, Dominion Laboratory normally withdraws from work in that field, thus becoming free to concentrate on new problems.

The technical work of the Laboratory is organized in sections and, for administrative purposes, these sections are grouped into divisions.

DIRECTOR'S RESEARCH GROUP

The Director's research group studies spontaneous ignition phenomena in wool and other materials.

A calorimeter has been designed to measure heat ouputs of 10^{-6} cal/sec g, and is being used to investigate kinetics of the reaction between pie wool and oxygen. An improvement has been made to the classical theory of the heat balance in spontaneous ignition, and this enables kinetic data to be used to calculate the parameters controlling ignition in baled wool.

Although it is thought that wet wool is not responsible for spontaneous ignition in commerce, most of the commercial upsets over heated bales in the New Zealand trade are caused by self-heating of damp wool bales. These upsets entail considerable financial loss. The causes of self-heating are being studied. Investigations are being made of the heat output of bacteria and of moulds, the heat output of wet sterile wool, and the maximum temperatures attainable by these mechanisms. These studies will determine whether or not bales of self-heated wet wool are safe.

In connection with studies of self-heating of wet materials, investigations have been made of spontaneous ignition in wet hay. The mechanism of ignition has been discovered and ignition of wet hay can now be produced at will under laboratory conditions.

The freezing industry is improving the Slipemaster process to produce better wool, and Dominion Laboratory is studying the ignition hazards of these modifications.

The diffusion of gases in bulk wool is being investigated to study diffusion constants, and to establish the degree of coupling between the diffusion of moisture and the diffusion of heat in bulk wool. The related phenomenon of heat of wetting of wool is also being investigated.

CHEMICAL ENGINEERING

The Chemical Engineering Section is concerned with basic research in chemical engineering, and with the extension and development of laboratory research findings to industrial scale. This involves pilot-plant investigations, and the Section is also equipped to design full-scale equipment and to supervise its construction and initial operation.

Geothermal studies at Wairakei include research on the mass-flow/enthalpy relationship in the discharge of wet steam, as measured by the critical-lip-pressure method. Present results indicate that this method will permit the measurement of bore outputs with simple, low-cost equipment.

Assistance to the N.Z. Steel Investigating Company in evaluating iron ore resources of the North Island involved the Section in extensive work on the magnetic concentration of ironsands.

Pilot-plant studies of the production of dissolving-pulp from *Pinus radiata* are being undertaken, and evaluation of this pulp is in progress.

To reduce labour costs and improve product quality, methods for the bulk curing and drying of tobacco are under investigation on a pilot-plant scale.

Fuel technology studies are directed towards improving the quality of delivered coal, its cleanliness and its convenience in use. These include briquetting investigations to assist in the problem of using surplus slack coal, and the design and operation of gas producers using sub-bituminous coal for the production of industrial producer gas, and for the automatic firing of small boilers. To encourage the increased use of coal in New Zealand, arrangements are being made with other Government Departments for the use (in small commercial-scale installation) of new coal-burning devices which can utilize coal cleanly, efficiently, automatically, and with maximum convenience to the user. The Laboratory assists in the selection, design, supervision and operational testing of these installations.

METALLURGY

In the Metallurgy Section research and investigational work is carried out on metallurgical and corrosion problems of importance to New Zealand. Advice is given to Government and industry on problems that arise within these fields.

A wide range of chemical and physical techniques is applied to the investigation of properties of metals, such as corrosion resistance, weldability, and service performance. Various methods are used to determine mechanical properties and the causes of service failures, and to study the effects and mechanisms of corrosion damage.

Typical corrosion investigations include corrosion in household and municipal water systems, electric-power generating equipment and topdressing aircraft, and assessment of the corrosive effects of chemicals used in aerial topdressing. A country-wide survey of copper and copper-alloy corrosion in domestic water installations is in progress.

The corrosive and associated effects of geothermal fluids are being investigated on a long-term basis. The phenomenon of micro-fissuring detected in stress corrosion tests at Wairakei is being studied as a possible intermediate state of sulphide stress cracking of carbon steels. It has been found that hydrogen in steel does not obey the standard laws of diffusion. A theory of diffusion has been developed which, if confirmed experimentally, will be of practical help in predicting corrosion and cracking behaviour of steels at Wairakei. The hydrogen-induced delayed fracture of bore casing steels exposed under tensile stress to geothermal media is being studied quantitatively.

Typical metallurgical investigations include radiographic examination of welds in boilers and other engineering structures, determination of the causes of service failures of metal components in aircraft, boilers, turbines, and hydro-electric equipment. Metals and metal components are tested to assess their mechanical properties. The load-compression characteristics of export wool bales, and the associated stresses in baling wires and wire joints, are being studied to explore the possibilities of economic improvements in wool baling and shipping practice.

A research project is being conducted on New Zealand ironsands as an extension of previous work on solid-phase, fluidized-bed reduction of the titanomagnetite sands. The effects of various thermal treatments on the metallic product are being studied to assess the possibilities of purifying the product by simple grinding, followed by magnetic separation of unwanted gangue minerals. The Section also co-operated with the N.Z. Steel Investigating Company in an economic feasibility study of steel production in New Zealand.

COAL

The properties and potentialities of New Zealand coals, and the promotion of their use, are investigated by the Coal Section. Chemical work is also undertaken in connection with safety in coal mines, including examination of coal dusts for explosibility, analysis of gases for toxicity and explosibility and examination of limestone dusts for suitability for use in coal mines. The explosibility of sulphur mixtures for aerial topdressing has also been studied.

An investigation is being made of the influence of coal structure and geological history on the moisture relationships of New Zealand coals.

South Island oil shales have been investigated for the Otago Development Council to explore possibilities of commercial development.

Methods of coal analysis are continually under review through the activities of the Solid Fuels Committee of the International Standards Organisation. Information which the laboratory receives as a member of this Committee helps considerably in developing special equipment. New methods of gas analysis for use both in the laboratory and in the field, are likewise continuously studied, and vapour-phase chromatographic techniques are used.

INORGANIC CHEMISTRY

The Inorganic Chemistry Section of the laboratory studies hydrothermal chemistry and the chemistry of rocks and economic minerals.

Studies are made of the discharges from drillholes at Wairakei to obtain the concentrations and variations of gas contents in the steam, and of chemicals dissolved in the waters. These results are applied as a geochemical prospecting method to choose sites for future holes, and to help explain the natural steam-producing processes.

The geochemistry of New Zealand hydrothermal areas is being studied in an attempt to show the origin of chemicals in the steam and waters, and to try to correlate the chemical differences between the areas with the local geology. Recently, the distribution of the minor element constituents such as fluorine, boron, rubidium, caesium, arsenic, antimony, bromine, and iodine, in thermal waters has been surveyed. In addition, laboratory studies have been made of the solutions resulting from the interaction of high-temperature water with various rock types.

The chemistry of sulphur-containing anions in solution has been investigated. The structures of the polythionate ions were deduced from their infra-red spectra, the stability of sulphur ions determined in water at elevated temperatures, and the rates of oxidation of hydrogen sulphide measured under various solution conditions.

Rock analysis for major constituents is carried out, both for the Geological Survey, and for the Laboratory's own geochemical work. Minor chemical constituents of the volcanic rocks of the central North Island are being investigated.

Assays and analyses of minerals are made to evaluate their potential usefulness to New Zealand. This work is carried out on the Laboratory's own initiative and on behalf of Geological Survey, Mines Department and private prospectors. Investigations of New Zealand resources of bentonite and filler clays were made recently. Geochemical prospecting techniques are being developed to assist the search for economic deposits of metallic ores.

CEMENT AND CONCRETE

The Cement and Concrete Section carries out research and investigational work on cement, the products of hydration of cement, and on certain other materials such as building stone. The Section investigates cases of concrete failure and provides technical advice and assistance for local bodies and industries.

Cases of "false set" at Benmore hydro-development led to a study of the effect of aeration on the setting properties of cement. The influence of various conditions of storage of cement on its mixing characteristics and subsequent strength development are also being studied.

The effect of variations in sulphate content of Portland and pozzolan cements on hydration processes and physical properties are being studied.

Pure chemical phases present in cement and concrete are being prepared, and their chemical and physical properties are being studied. This investigation is closely allied to an examination of geothermal cement grouting. The effect of alumina and iron oxide on hydrous calcium silicate formation is receiving attention.

The suitability of strength tests of concrete to indicate cement quality is being studied using normal and accelerated curing.

Spent chemical liquor from Whakatane Board Mills has been evaluated as a concrete additive. Liquor which has been fractionated on a semi-pilot-plant scale is being tested in concrete. Effects of sugars and delayed accelerators are also receiving attention.

A study is being made of the properties of heavy concrete suitable for use as nuclear shielding, made with New Zealand barites.

The properties of lightweight concrete containing New Zealand pumice or artificial aggregate (*e.g.*, expanded shale) are being investigated. The project has as its aim the wider use of pumice and other forms of lightweight concrete for precast, insulating and structural concrete generally.

PAINT AND PETROLEUM

The Paint and Petroleum Section studies the chemistry and performance of paint coatings and also checks the quality of paint and petroleum purchased by the Government for use in its public works and services.

Long-term studies of the durability of exterior paints for wood have been in progress for a number of years. These experiments include a study of factors affecting the durability of paint on radiata pine and native timber, and the possible effects of various wood-preservative treatments. Exposure tests have been carried out on a number of clear finishes for exterior woodwork, and on the proprietary "high gloss" paints available on the market. Priming paints are being formulated for radiata pine weatherboards and field trials on houses are in progress.

Tests on protective coatings for structural steel are in progress at various localities and a series of zinc-rich paints has recently been included in the programme.

Research into paints for underwater steel has been directed to three main problems, the selection of suitable coatings and their specification, the quality control of supplies of paint, and investigation of the problems of field application.

An investigation has been made of the Karl Fischer method of estimating water in lubricating grease, and the results compared with the standard methods. The viscosity of cellulose solutions is also being studied and molecular weight distributions determined. A study has been made of the solvency of fuel oils for pentachlorophenol wood preservative.

ORGANIC CHEMISTRY

The extractives present in native and exotic timbers are being studied by the Organic Chemistry Section. The commercial possibilities of these materials are also being evaluated.

A new method has been developed for analysing small samples of essential oils, and several hundred oleoresin samples from New Zealand forests, and from the native *Pinus radiata* provenances in California, have been examined. It has been shown that the composition of the essential oil is under a simple rather than a complex genetic control, and that this composition offers a method for determining the degree of hybridism within the forests. The possibility of preparing resin acids from "Tall Oil" and beta pinene from sulphate turpentine is also being studied.

Following investigations in this laboratory, "manool" is now accepted as a commercial intermediate in the production of synthetic perfume basis similar to ambergris, and a New Zealand firm has supplied some 200 kilograms to one of the perfume houses in Switzerland.

Together with these applied projects, the fundamental chemistry of manool and related diterpenes has been intensively studied and two new compounds have been isolated. A new unsaturated diterpene hydrocarbon named "biformene" is present together with manool in *Dacrydium biforme*, and its structure has been determined. A compound named colensone oxide (related to oxomanoyl oxide) has also been isolated from *D. colensoi*, and the structure established as 3-nor-oxomanoyl oxide. Instrumental techniques, such as N.M.R., are being applied to these organic structure studies.

Pulping studies of *Pinus radiata* have shown that following prehydrolysis, and conventional kraft cooking, a wood pulp can be prepared that is readily bleached to yield a high alpha cellulose pulp. The fundamental chemical changes occurring during the preparation of this material are being studied by examination of the liquor constituents.

An infra-red group of the Organic Chemistry Section has developed the assay of trans unsaturation in fatty acids, has developed methods of identification of the pyrolysis products of natural and synthetic rubbers, and has completed a comprehensive study of the infra-red spectra of synthetic fibres. Further refinements of the differential method of analysis are being made, and two variable length cells are now used. In addition to these research projects, assistance is being given to the universities now installing infra-red spectrophotometers, and infra-red work on facial eczema is still proceeding.

PHYSICAL CHEMISTRY

In the Physical Chemistry Section investigations are made into various problems covering the broad field of physical chemistry, and research effort is concentrated on three major techniques. These are emission spectrography, X-ray diffraction, and nuclear magnetic resonance.

In the field of emission spectrography, major problems are caused by the influence of the sample itself, the base, on the emission of the elements being determined, and existing methods are constantly being reviewed and improved to reduce these effects to a minimum. In a recent application, exclusion of oxygen from the arc eliminated interference by silicon oxide band emission in the determination of boron in silicate rocks.

An X-ray diffractometer is used for identification of a wide variety of compounds. This technique has been applied to such diverse research projects as influence of lignosulphonates on hydration of tricalcium aluminate, the polymorphism of barbiturates, the state of hydration of various inorganic salts and minerals, and thermally induced phase changes in organic compounds. For the examination of multiphase, single-component systems, quantitative diffractometry, both direct, and with reference to internal standards, has been developed. The determination of crystal structures, using single crystal techniques, is carried out with the co-operation of the Applied Mathematics Laboratory in performing computations. These studies are applied to determination of structures of organic molecules, and to the mechanism of thermally induced phase changes.

Since the installation of a Varian DP60 Nuclear Magnetic Resonance Spectrometer, high resolution proton spectra of organic molecules have been recorded, and structures deduced. The application of multiple resonance methods to eliminate spin-spin coupling has resulted in simplification of complex spectra, and facilitated assignment of spectral peaks to functional groups in complex molecules. The nuclear resonance of fluorine, phosphorus, boron and carbon-13 can also be studied, permitting investigations of a wide variety of compounds, both organic and inorganic. Wide-line studies of other nuclei, and of solids can be undertaken, providing a useful aid to X-ray single crystal studies of organic molecules.

PESTICIDES

The Pesticides Section carries out research and advisory work on pesticides. Toxicological and forensic science investigations are also attached to this section and specialized assistance is given to many Government Departments on a wide range of problems.

Poisonous pesticide materials are used almost universally to control pests on fruit, vegetables and seed crops. Investigations are carried out to assess the amount of residue at harvest time under various application conditions, and to trace the rate of degradation of systemic poisons within the plant. From these findings, application schedules that will produce food safe for consumption can be drawn up. DDT is applied to pasture for pest control. The physical nature of the application affects the amount retained on the pasture, and hence the level of contamination of meat and dairy products when the pasture is consumed by animals. These problems are being studied.

Certain apple varieties develop on storage a condition known as apple scald. Previously, this was partially controlled by oil wraps, but present work is directed towards finding the best conditions for adequate control with diphenylamine and ethoxyquin, and in determining the amount of these substances remaining on and within apples after differing treatments and storage periods.

FOOD AND DRUGS

The laboratory has, for over half a century, been associated with the Department of Health in establishing the high standard of food and drugs available in New Zealand. The Food and Drugs Section investigates special problems affecting public health and provides chemical information to assist in the control of the quality of food, drugs, and water supplies.

Existing and proposed public water supplies are regularly examined for quality. Polluted river water, industrial waste and sewage disposal effluents are regularly analysed. With the introduction of fluoridation of town water supplies, the section guides the local water authorities in setting up adequate control and ensures that the correct dosage is maintained. Water corrosion problems are studied in conjunction with the Metallurgy Section.

Bacteriological studies are made of water, milk, ice-cream, and milk-can and milk-bottle washes. Further studies are undertaken relating to river pollution, bathing beaches, and school baths. The possible presence of antibiotics in milk (as a result of treatment of dairy cattle) is checked so that the sale of such milk may be prevented.

Harmful trace metals, particularly lead, are a continuing problem in food. Beverages may be contaminated, and some glazed china has proved unsatisfactory in this respect. The quality of kitchen-ware in New Zealand has improved as a result of these investigations.

The Vitamin C content of fruit varies considerably within a variety and with season and maturity. Tree tomato and chinese gooseberry fruits, both of which are an excellent source of Vitamin C, are being studied. The presence of foreign fat in chocolate is being investigated. Chromatography is being applied to the identification and analysis of food and drugs.

DISTRICT LABORATORIES

District Laboratories are maintained in Auckland, Christchurch and Dunedin to deal with aspects of public health and forensic chemistry. Their main functions are the analysis of foods, drugs and waters for the Department of Health, and toxicology and forensic investigations for the Police Department. Analytical and advisory work is carried out for other Government Departments and some work is done for industry. Town gas supplies in city and provincial towns are examined under the Gas Industry Regulations 1960 for calorific value, purity and pressure. Within the above fields several projects are being investigated.

Bacteriological and chemical studies have been made in the Auckland Harbour and in the Christchurch Estuaries. The Christchurch studies indicate that there is a transformation of inorganic nitrogen to organic nitrogen.

Air pollution problems are being investigated at Auckland and Christchurch, and information regarding the nature and degree of pollution is being accumulated.

A special study has been made of the properties of glass, since fragments of glass from the scene of accidents often provide useful forensic evidence.

The District Laboratories carry out regular tests on local milk supplies. In addition to safeguarding quality, much information has been obtained on the seasonal and annual variations in composition and on methods of analysis. Proteins in milk have been a special study.

Water supplies are examined regularly and special investigations made on mineral and other constituents. Assistance is given in controlling chlorination and in the purification of water supplies.

Considerable attention has been given to the determination and interpretation of alcohol in blood and urine in traffic offences.

AFFILIATION OF THE N.Z. INSTITUTE OF CHEMISTRY WITH THE ROYAL SOCIETY OF NEW ZEALAND

At the Annual Meeting of the Institute at the Palmerston North Conference it was agreed that a committee should be set up to confer with representatives of the Royal Society of New Zealand and report on two matters:

(1) The question of affiliation with the Society, and the issues involved therein; and

(2) Other ways of co-operation between the Institute and the Society short of affiliation.

The Institute representatives were Dr W. E. Harvey (General Secretary), Mr W. G. Hughson and Dr F. B. Shorland (Past-Presidents) and Miss Joan Mattingley (Wellington delegate). They met twice as a group alone and twice with the Royal Society representatives who were Dr J. K. Dixon (a Past-President of both bodies), Sir Ernest Marsden, F.R.S., Dr M. A. F. Barnett (Vice-President of the Society) and Mr K. R. Allen (a past Vice-President).

At present the Institute co-operates with the Society in joint participation in the triennial New Zealand Science Congresses, in nominating members of the Society's Sectional Committee for Chemistry and on the National Committee for Chemistry which will be set up when adherence to the International Union of Pure and Applied Chemistry is completed. The committee could see no ways of increased co-operation short of affiliation which thus becomes the only issue for decision by the Institute.

The reports of the meetings of the committee were available at the Council meeting on November 27 when it was decided to prepare the following statement for submission to branches and for publication in the *Journal*. Each Branch is to give its members an opportunity to discuss this matter in open meeting and delegates are asked to report back to the May meeting of Council.

CONDITIONS OF AFFILIATION

(1) By a new rule approved by the Council of the Royal Society last November, any body of scientists can qualify for affiliation if it spends at least one quarter of its income on scientific publications approved by the Society and/or in contributions to the expenses of visiting scientists. The general opinion of the combined committee was that the *Journal of the N.Z. Institute of*

Chemistry would be an approved publication and the money spent on it plus the Institute's contribution towards the expenses of visiting scientists would make up the one quarter of income specified.

(2) The Society also has a rule that any member of an affiliated body may *voluntarily* elect to become a contributing member of the Society and pay an extra 5s. to the Society's funds (in this case through the Institute. The proportion of members of the various bodies which are at present affiliated with the Society who pay this 5s. varies from less than 3% to 100%). It may be felt that there is moral obligation on the Institute to pay a lump sum to the Society rather than a number of individual 5s. subscriptions. The size of this contribution would, however, necessarily be governed by the state of the Institute's funds and the financial support received by the Society from other sources.

(3) The Institute would have the right to appoint one member to the Council of the Society.

(4) The Institute would have the right to withdraw from affiliation with the Society at any time that it saw fit.

(5) The autonomy of the Institute would not be affected in any way; the Society would have no say in the professional standards set by the Institute, nor would members of any other affiliated bodies have any right to participate in Institute activities or meetings except by invitation.

Some concern has been expressed by members of the Institute over the composition of the Council of the Society which need not be composed of professional scientists. However, the President and the two Vice-Presidents must be Fellows of the Society, which means that they are scientists of high attainment and a large majority of the present Council are in fact professional scientists. This majority is likely to increase in future.

Points in favour of affiliation are:

(1) The Royal Society is recognized by the N.Z. Government and overseas organizations generally as representing science in this country. Thus, the recent decision that New Zealand should become a member of the International Union of Pure and Applied Chemistry had to be made by the Society, and the necessary fees will be paid by the Society with funds supplied by the Government. This could be of great benefit to the Institute. The same situation applies with regard to New Zealand's adherence to other international scientific bodies.

(2) The Royal Society, by Act of Parliament, has the right to make representations to the Government on any matters of scientific interest and the Institute could express its views to the Government through the Society.

(3) The Society has access to Government funds which could increase in future and which could be used to assist the Institute in its publications and overseas visits. It is also more than possible that the Society may within the not too distant future obtain its own premises which could house the Institute's secretariat. At present we are dependent on the goodwill of the General Secretary and other officials to house the Institute's papers and records.

(4) It is certain that, in future, there will be a considerable growth in science in New Zealand and the question of chemists being able to contribute to the best advantage in shaping the policy, as well as receiving the benefits from this growth, is largely tied in with the Institute's affiliation with the Royal Society.

(5) A point which is of particular interest at present is that there are a number of issues (some of which are confidential to members of the Council of the Society) now being discussed by that Council which could greatly affect the whole constitution of the Society and the future of the organization of science in New Zealand. By affiliation this year (1964) the Institute could have a voice in matters which may be of benefit to all scientists and in which chemists could share.

W. E. HARVEY,
Gen. Secretary

COAL RESEARCH FELLOWSHIP

Through the generosity of Mr W. A. Stevenson, of Howick, a fellowship has been established to further research in New Zealand into the use of local coals, particularly for purposes such as briquetting, pellet-making and pulverized coal firing. It is expected that a chemist or chemical engineer will be appointed as Stevenson Fellow and technical staff to assist him will be made available. Laboratory accommodation and facilities for this team will be provided at the Coal Research Section of the Chemistry Division, D.S.I.R., at Gracefield, where work in this field is already in progress.

Mr Stevenson, who has provided the funds of this fellowship, has been actively associated with open-cast mining in the Waikato for a number of years.

INSTITUTE BUSINESS

The following notes, prepared by the General Secretary, refer to items of Institute business which will be discussed by branch committees in the near future. They are published here for the information of members, unable to attend branch meetings, who may wish to offer ideas on these subjects to branch committee members or to the Secretary directly.

VICE-PRESIDENTS

At the last Annual General Meeting of the Institute, Dr Shorland suggested that there may be advantages in extending the term of office of the President to two years. Under the present Rules, there is no objection to the President being nominated for a second one-year term, but the term of office must not exceed two years.

Although the President in any year will normally have been a member of Council (as Vice-President) in the previous year, Council meetings are now held only three times a year, and the view has been expressed that a newly-elected President may have had relatively little experience of Council meetings and deliberations. Council discussed this matter, and it was considered that it may be desirable to enlarge the Council by one member by introducing the office of second Vice-President. It is envisaged that the second Vice-President in any year would probably become the first Vice-President and then the President in succeeding years, although, as is the case at present, elections would be held annually for all the offices.

If the scheme suggested is to be adopted, changes in the Rules will be necessary. The Rules are at present being reprinted and it would be desirable to make these changes before they are issued. For this reason, branches are asked to give urgent consideration to the proposals, so that any changes which are agreed upon can be made without delay.

ASSOCIATESHIP BY EXAMINATION

Council hopes to complete shortly the redrafting of the Regulation covering admission to the Associateship by examination and branches and/or branch committees are asked to comment on the following at an early date.

BACKGROUND

In the past, very few Associates have qualified by examination. Most, if not all of those who have done so have not been required to sit examinations other than a practical examination since they have been, in the main, people who have passed Chemistry III and have therefore been exempted from the written papers. With the introduction of the National Certificate in Science (Chemistry), which has replaced the Laboratory Assistant's Certificate, and which, in its final stages, reaches a considerably higher standard than that of the L.A.C., it seems likely that there will be a greater demand for Associateship examinations, and with this in mind Council some time ago asked the Examinations Committee to review the existing Regulation. The reworded Regulation is very similar to the original but certain sections have been clarified and amplified.

It appears that there are a number of rather general questions still unsettled, and it was hoped that guidance on these points might be obtained as a result of the meeting of chemical society secretaries held in London in July, 1963. In fact, this item on the agenda received little attention, and it appears that the N.Z.I.C. must move on its own.

The following matters appear to require discussion and decision:

(1) ARRANGEMENTS FOR EXAMINATION

The Regulation does not state whether or not all sections (the three written papers, the practical examination, translation) must be taken at one time, nor does it state the pass conditions (*e.g.*, whether a pass in each of the three written papers is required, or whether the marks for all the sections of the examinations are averaged). If all sections of the examination must be completed at once (*c.f.*, degree examinations), there may be a case for introducing a lower level qualifying examination analogous to Chemistry II. If all sections need not be completed together, then should there be some time limit over which they may be spread, and, if so, what time limits should be imposed, and are additional restrictions then also necessary?

(2) EXAMINATION PAPERS AND SYLLABI

The Examinations Committee has recommended that the universities be approached to see if they would allow candidates to attend Chemistry III lectures and to sit the examinations at the end of the year. There would appear to be no major obstacle to this course, and it might be considered that in the meantime at least, while the number of candidates is likely to be very small, no alternative to the university examination should be offered except for the papers on some special branch which would of necessity have to be specially set. If the university examinations are utilized, this could mean that in any year different candidates could be sitting different papers (in different centres). This may or may not be important. University examination papers would presumably slightly favour the candidates who had attended the university lecture course.

The question of tuition is a separate one. The Institute does not intend to run courses and the candidate would be free to choose attendance at university or to work on his own as he desired. The syllabi drawn up would be a useful guide to the candidate who chose not to attend lectures.

It is possible that the polytechnics, where they are established, may have courses (especially practical courses) which would be of assistance to candidates for the Associateship.

The setting and marking of the practical examination and the paper on translation should remain a function of the Institute since there should be no difficulty in handling these and it is most unlikely that any suitable alternative examination will be available.

Council would be pleased to have any comments or suggestions that branches may have to offer on the Associateship examination in general, or on the matters outlined above.

BRANCH NEWS AND NOTES

AUCKLAND

The U.S. Public Health Service, in conjunction with the U.S. State Department, has made a grant of £10,800 to Professor R. E. F. Matthews, head of the Microbiology Department at Auckland University, for research into virus inhibition and nucleic acids. In addition, the Damon Runyon Memorial Fund for Cancer Research has granted £3,700 to Dr P. L. Bergquist, research fellow in the same department, for work on the chemotherapy of cancer and the carcinogenic process.

In December, Professor A. L. Odell spoke to the Branch about his recent visit to the U.S.A., and, in February, Dr D. S. Letham of the D.S.I.R. spoke to the Branch on plant kinins. The isolation and identification of "zeatin", the first of these plant cell division stimulants to be obtained in crystalline form, were described.

It has been announced in Auckland that a company called Forest Investigations Ltd., which is backed by New Zealand and Australian interests, is to determine whether an economic mill capable of producing 60,000 to 70,000 tons of chemical pulp can be established in Nelson.

Professor D. R. Llewellyn, Professor of Chemistry at Auckland University, has accepted the position of Vice-Chancellor of Waikato University which is to be developed at Hillcrest.

Two Branch members, Mr A. W. Mackney, a director of N.Z. Forest Products Ltd., and Mr K. E. Seal, the Chief Technical Officer of Amalgamated Brick and Pipe Co. Ltd., were recently appointed to the newly-formed National Research Advisory Council which is to advise the Minister of Science on matters related to the development of science in New Zealand.

Professor L. H. Briggs is the recipient of grants totalling more than £7,000 in support of research to study the chemical constituents of New Zealand plants and fungi. A substantial part of this sum will be received from the University Research Grants Committee to purchase an automatic spectropolarimeter; the other part of the grant has been made by the Rockefeller Foundation of New York.

WAIKATO

Dr W. G. Whittleston, a former member of the Branch, has returned to the staff of Ruakura Agricultural Research Centre after five years' sojourn in the University of Sydney wilderness.

Miss Janice Gumbley, who is on leave from Ruakura, is working in the Biochemistry Department, Cambridge, with Dr Korner's team in the field of protein biosynthesis.

Dr R. Hodges, the Branch Secretary, leaves for Japan in April to attend the I.U.P.A.C. Congress at Kyoto. He will present a paper entitled "The structure of loliolide, a terpene from *Lolium perenne*".

MANAWATU

Dr A. T. Johns and Dr W. A. McGillivray are to be congratulated on their election to the Council of Massey University of Manawatu. Dr Johns was subsequently elected Pro-Chancellor by the Council.

Last November, Dr Johns visited Australia, as a guest of the Australian Beef Cattle Research Committee, to advise on bloat research.

We offer our best wishes to Dr H. R. Whitehead who retires in March after 36 years with The Dairy Research Institute. His place as Director is to be filled by Dr F. H. McDowall. We congratulate him, and also Dr W. A. McGillivray who has been appointed the new Deputy Director and will become Director of the Institute upon Dr McDowall's retirement in 2 years' time.

Dr McGillivray and Dr R. M. Dolby recently spent seven weeks in East Asia and Japan with the Dairy Board Scientific Technical Commission. Dr McGillivray has also been given six months' leave of absence to visit dairy research centres overseas. He leaves for Britain in May.

Mr J. Erskine has been awarded a D.R.I. Research Fellowship and is now at the University of London working on phage genetics.

Dr E. Wong has returned to the Plant Chemistry Division from U.C.L.A., California, where he has been working with Professor Geissman on isoflavone chemistry.

Dr Blanche Gaillard, from Holland, is on study leave at the Plant Chemistry Division working on plant carbohydrates with Dr Bailey.

Dr G. Peterson has been awarded a Carnegie Travel Grant to visit various research institutes in the United States on his way back to New Zealand. He has recently spent two years in the Department of Biochemistry at Oxford.

Mr D. W. King is visiting Australia in April for two weeks to inspect advances made in cheese mechanization in that country.

Mr G. Latimer has resigned from The Dairy Research Institute to accept a Senior Lectureship in Engineering at Massey University.

Mr J. Sargent has returned from India where he has completed a 15-months' assignment under the Colombo Plan at the National Dairy Research Institute, Karnal, Punjab.

Dr J. C. Hawke has been awarded a Fulbright Travel Grant to work on lipid metabolism with Professor Stumpf at Davis, University of California. He will be attending the International Congress of Biochemistry in New York in September.

Dr M. G. Rumsby has joined the staff of the Biochemistry Department at Massey University. Dr Rumsby came from the University of Birmingham where he has been working with Dr Finean on lipid chemistry.

Dr R. D. Batt, of the University of Otago, has been appointed to one of the two chairs in biological sciences at Massey University and will take up his duties in August.

Miss M. A. Humphries has accepted an appointment to lecture in nutrition and food evaluation in the Food Technology Department at Massey University.

The first N.Z. Food Technology Conference will be held at Massey University, Palmerston North, in the last week of May this year. The conference is being organized by the Faculty of Food Science and Biotechnology and will be residential. A programme and details of the conference can be obtained from the Food Technology Department, Massey University.

WELLINGTON

During 1963, the Wellington Branch held its annual programme for secondary school pupils. On the first of the two evenings films were shown to a large audience; on the second, Dr W. E. Harvey presented a lecture entitled "Chemistry and Biology".

The Department of Chemistry at Victoria University included in its activities for 1963 two courses which proved to be of national interest. These were a course on Laboratory Instrumentation, which included among its tutors Dr L. E. Smythe from the A.A.E.C. Research Establishment, Lucas Heights, and a course on Chromatography, in which Mr R. Dewar from I.C.I. (Melbourne) was one of many prominent lecturers.

Dr June Sutor, a crystallographer, has joined the staff of the D.S.I.R. at Lower Hutt. Dr Sutor was previously working at Birkbeck College, University of London.

Dr N. F. Curtis, of the Department of Chemistry, Victoria University, at present on sabbatical leave, is working with Professor F. A. Cotton at the Massachusetts Institute of Technology.

Dr M. D. Carr has joined the Department of Chemistry, Victoria University, after having completed a Ph.D. at University College, London, under Dr. C. A. Bunton, and a Post-doctoral Fellowship at the Dyson Perrins Laboratory, Oxford.

Mr R. G. Burns, at present completing a Ph.D. at the University of California, Berkeley, has been appointed to the position of Senior Lecturer in Geochemistry at Victoria University.

The newly-created chair of Biochemistry at Victoria University has been filled by Professor J. N. Smith. Professor Smith previously held the position of Senior Lecturer in Biochemistry at St. Mary's Hospital Medical School.

Dr F. J. Darby has joined the Department of Biochemistry at Victoria University as a lecturer. Dr Darby is a graduate of University College, London.

The annual prizes offered by the Wellington Branch to the top students in the Chemistry Stage I and Chemistry Stage II classes at Victoria University have been awarded to Messrs L. E. Main and J. P. M. Bailey respectively.

CAWTHRON INSTITUTE, NELSON

Dr M. E. W. Taylor arrived in Nelson early in December, 1963, to take up a Thomas Cawthron Fellowship at the Cawthron Institute. He was awarded the Ph.D. (organic chemistry) by the University of London on presenting a thesis embodying results from an investigation on fungal metabolism carried out at the London School of Tropical Medicine and Hygiene. He then joined the Fisheries Research Laboratory (Ministry of Agriculture, Food and Fisheries), at Lowestoft, and later worked at Fison's Leavington Research Station. He then held a Fellowship at the Institute of Marine Science, Bergen, Norway. Dr Taylor's fishery investigations were basically fundamental chemistry, but included interesting seagoing experiences. At the Cawthron Institute he is initiating investigations into the nature of toxic principles of certain fungi of importance in commercial horticulture.

Both Dr and Mrs Taylor, who is a schoolteacher, are already enjoying the sea coast and mountain sports of the Nelson district.

Dr J. R. L. Walker, biochemist, Cawthron Institute, has been awarded an Underwood Senior Research Fellowship by the Agricultural Research Council of Great Britain. He has been granted leave from the Institute and will depart with his wife and family in September to take up the Fellowship. A year will be spent at the Ditton Laboratory of the Food Investigation Board, located near Maidstone, Kent. There he will continue his present investigations on the polyphenol-polyphenolase systems in plants with Dr A. C. Hulme, an authority on this subject. Dr Walker intends spending some time visiting laboratories, in particular those working on problems relating to his own field of work in plant biochemistry.

CANTERBURY

The following members of the Chemistry Department of the University of Canterbury attended the ANZAAS conference at Canberra during January: Professor J. Packer, Dr J. E. Fergusson, Dr A. Fischer, Dr M. P. Hartshorn, Dr W. S. Metcalf, Dr L. F. Phillips and Dr R. D. Topsom. Professor Packer was a Vice-President of the Chemistry Section, Dr Topsom gave an invited review paper at a pre-ANZAAS conference on heterocyclics and the other members presented research papers during ANZAAS. The standard of the papers presented was high and there were interesting opportunities to attend sessions in other disciplines, notably physics and biochemistry. Most of the contingent also visited laboratories in Sydney and Melbourne before or after the conference, or went on one of the organized tours in the Canberra area.

The new Professor of Biochemistry at Lincoln College is expected to take up his position at the end of April. He is Dr B. H. Howard, who gained a B.Sc.(Hons.) in chemistry from Manchester University (1941) and a Ph.D. in Biochemistry from the University of London. He was elected an Associate of the Royal Institute of Chemistry in 1947 and made a Fellow in 1958. His present position is that of Principal Scientific Officer in the department of Microbiology, Rowett Research Institute, Bucksburn, Aberdeen. During 1961–2 he was a senior research fellow of the D.S.I.R., working with Dr A. T. Johns at the Plant Chemistry Division in Palmerston North.

Mr F. Barnes, formerly Chief Chemist, Fletcher Plywood Ltd., Christchurch, has been appointed Development Officer for the South Island area of Fletcher Industries Ltd.

Two recent arrivals at the University of Canterbury are Dr T. P. Cotter of the Los Alamos Scientific Laboratory, who is on an eight months' visit, and Dr A. Metcalfe, formerly of Bristol University, England, and Dalhousie University, Canada, who has been appointed as a lecturer in physical chemistry. Dr Cotter has been working in fields related to plasma physics and thermodynamics, while Dr Metcalfe has been concerned mainly with heterogeneous catalysis, especially that involving metal surfaces. Dr D. A. R. Happer, Dr W. T. Robinson and Dr W. R. Roper have recently departed from the University of Canterbury to take up post-doctoral fellowships in the United States, while Dr W. J. Galloway has left to take up a position with Du Pont in Canada.

Chemistry in Action

Three lectures to sixth-form secondary-school pupils have been held:

March 20: "The chemical basis of heredity", by Professor R. E. F. Matthews, Auckland University.

April 3: "Forces between molecules", by Professor H. N. Parton, University of Otago.
April 10: "Chemistry and ceramics", by Mr K. E. Seal, Chief Chemist, Amalgamated Brick and Pipe Co. Ltd., Auckland.

Junior Chemical Society

The year's programme begins with a lecture by Mr D. J. Higgins, Chief Production Supervisor, Kempthorne Prosser Ltd., on "Some aspects of fertiliser manufacture". Later, lectures will be given by Dr D. S. Adcock, N.Z. Refining Co., Whangarei, and by Professor J. Vaughan of the University of Canterbury. There will also be visits to Lincoln College and to the Chemistry Department of the University of Canterbury, and competition for the Unilever Awards and the Shell Essay Prize.

OTAGO

Dr R. D. Batt, Associate Professor of Biochemistry at Otago University, has recently been appointed Professor of Biochemistry at Massey University of Manawatu. Professor Batt started his career in the Department of Chemistry at Otago where he took the degrees of M.Sc. and Ph.D. in organic chemistry and was Assistant Lecturer in chemistry in 1948. Following this, he spent four years at Oxford where he took an M.A. in physiology and D.Phil. in Biochemistry. While at Oxford, he was Nuffield demonstrator in Biochemistry. On his return to Otago, Dr Batt was appointed Lecturer and then Senior Lecturer in Biochemistry. In 1959, he was awarded a Nuffield

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CANTERBURY BRANCH CHAIRMAN 1963–64

Mr R. W. Cawley completed his M.Sc. training in 1947 at Auckland University College, then spent two years in the Biochemistry Department at Massey Agricultural College as temporary Assistant Lecturer. He joined the staff of the Wheat Research Institute, Christchurch, in 1950, and spent 1952 in the Biochemistry Department, University of Otago, on study leave.

He left the Institute in 1956 to become Assistant Factory Manager of T. J. Edmonds Ltd. In 1958, he rejoined the Institute's staff and is now Assistant Director.

He has recently returned to New Zealand after seven months as a C.S.I.R.O. Research Fellow at Wheat Research Unit, Sydney. His research interests are in the biochemistry of the breadmaking process.

Mr Cawley has served on the Canterbury Branch Committee as Branch Secretary and as Council delegate.

Fellowship and spent a further year at Oxford. Since 1960, he has been Associate Professor in Biochemistry. Professor Batt's research has been concerned mainly with the application of radioisotope techniques to metabolic problems in living organisms with particular reference to the metabolism of soil micro-organisms, a field in which he has published some 30 papers.

Professor Batt has played a very active part in the Institute of Chemistry of which he is a Fellow and his departure in August to take up his new appointment will be keenly felt by the Otago Branch.

Dr W. G. Hangar, Secretary of the Otago Branch of the Institute, has been appointed Works Manager for McSkimming Industries Ltd's factory at Benhar. Dr Hangar's new address is: c/o McSkimming Industries Ltd., P.O. Box 46, Balclutha.

LABORATORY SAFETY NOTES

Following a suggestion from Mr Huntly Horn we invite members to submit short notes on laboratory "incidents" which may serve as a warning to others, or on safety measures which they have found useful. These will be published anonymously if the contributor wishes.

Several incidents involving electrical leads and wiring have come recently to the writer's attention.

(1) A cab-tyre lead to a vacuum pump had been, apparently for some time, in contact with the drive pulley or belt. In two places the insulation had been worn through to expose 2 to 3 inches of wire. Fortunately in both places only the earth wire was exposed.

(2) On a crowded bench in a low temperature room the looped lead to a centrifuge had been confined between the centrifuge casing and the hot shielding of a rheostat. The writer was summoned by telephone to deal with the resulting fire because the professional officer (not a chemist) who discovered it was uncertain whether the CO_2 extinguisher which he had picked up was safe to use with electrical apparatus!

(3) A firm making mechanical repairs to a centrifuge of American manufacture broke and replaced the 3-pin plug. Before using the centrifuge the writer decided that the lead should also be renewed. It was thus discovered that the original lead was not connected to the switch on the machine according to New Zealand convention and that replacement of the plug according to convention had connected the frame of the centrifuge directly to the phase line.

(4) A heating mantle was borrowed by another institution, where it became defective and was repaired. Some weeks after it was returned a technician received a severe shock when he touched a water tap and the control unit at the same time. The exact history of the repair work was not fully unravelled, but the phase side of the circuit was found to include the non-earthed casing of the control unit.

A three-monthly check of all leads and plugs in the laboratory has been instituted.

N.T.C.

CORRESPONDENCE

LABORATORY SAFETY

SIR,—In response to your editorial invitation, I have the following comments to make on Mr Horn's article "Safety and First-aid in Science":

(1) The Fisher wall chart is *not* "the only one available from either commercial or official sources". I have recently displayed in my laboratory an excellent "Laboratory First Aid" chart supplied by The British Drug Houses Ltd., B.D.H. Laboratory Chemicals Division, Poole, Dorset, England.

To quote, "Measuring approximately 30 × 38 inches (76 × 96 cm) and boldly printed on stout paper in four colours, the B.D.H. Laboratory First Aid Chart provides immediate reference to first aid measures in the event of laboratory accidents. The information on the chart is based on the *Laboratory Handbook of Toxic Agents* published by The Royal Institute of Chemistry, and is reproduced by permission. The appropriate first aid treatment for accidents (inhalation, skin contact, ingestion by mouth, or eye contact) caused by any one of nearly 200 chemicals or classes of chemicals is clearly shown on the chart, together with general notes on laboratory first aid and instructions and diagrams for administering artificial respiration.

B.D.H. will be happy to send a complimentary copy of the chart to any laboratory on request in response to this advertisement [Chemical Society *Proceedings*]. Further copies may be obtained at the production cost of 5s. 0d. per copy, including postage".

I would recommend that this chart be displayed in all chemical and biochemical laboratories.

(2) Since there are completely *revised 1963* editions of Gleason and Dreisbach, items (4) and (6) should read as follows:

  (4) Gleason, Gosselin and Hodge, 1963. *Clinical Toxicology of Commercial Products* [Acute poisoning (Home and Farm)], Williams and Wilkins (Baltimore) ($22).

  (6) Dreisbach, 1963. *Handbook of Poisoning: Diagnosis and Treatment*, Lange Medical Publications (California) (32s.).

(3) The bibliography should include a list of Elsevier Monographs on Toxic Agents. These monographs which describe the chemistry, biochemistry, toxicology, pharmacology, health hazards and first-aid treatments of compounds and groups of compounds should be in all chemical libraries. Those already published include:

Toxicology and Biochemistry of Aromatic Hydrocarbons, by H. W. Gerarde.
Toxic Aliphatic Fluorine Compounds, by F. L. M. Pattison.
Toxicity of Arsenic Compounds, by W. D. Buchanan.
Carcinogenic and Chronic Toxic Hazards of Aromatic Amines, by T. S. Scott.
Toxicity of Beryllium Compounds, by L. B. Tepper, H. L. Hardy and R. I. Chamberlin.

(4) With increasing knowledge from modern toxicological investigations of chemicals, it is becoming increasingly clear that university departments of chemistry and biochemistry will have to

> give serious consideration to the provision for students of some lectures dealing with the hazards, properties, precautions and toxicity of chemicals and solvents. Let me emphasize my point by considering a simple and commonly-used laboratory reagent, diazomethane. This elegant methylating agent is usually prepared by alkaline degradation of *N*-nitrosomethylamine derivatives such as *N*-nitrosomethylurethane, *N*-nitrosomethylurea and *N*-nitroso-β-methylamino-isobutylmethylketone. The substituted urethane has recently been shown to be a potent carcinogen in acute toxicity studies in rats (Druckrey & Preussmann, 1962). The actual carcinogen is diazomethane itself (Schoenthal, 1960), easily formed from the unstable nitrosomethylurethane by hydrolysis. This substance should therefore be handled with the greatest care and be replaced in the laboratory preparation of diazomethane by the use of the relatively stable, non-toxic and non-carcinogenic *N*-nitroso-*N*-methyl-p-toluenesulphonamide, wherever possible.

I trust that the Council will fully consider Mr Horn's suggestion of reprinting the appendix (or article) and arranging for its distribution to Institute members, schools and students. This has my strong support.

J. C. DACRE
Pathology Research (Toxicology Laboratory),
N.Z. Medical Research Council,
Medical School, Dunedin

REFERENCES

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Schoental, R. 1960: *Nature* [Lond.], *188*: 420.

SIR,—I congratulate Mr A. H. Horn on his apposite article in the February *Journal.*

I also welcome the opportunity to draw attention to the negligent attitude of British scientists towards a particular type of fire hazard which has been in existence for over fifty years: I refer to the recovery of fat solvent residues of which the largest proportion are petroleum ether, sulphuric ether and ethanol.

Some of the earlier industrial laboratories in the United Kingdom were converted from offices, space was at a premium and side rooms were required for the microscope and polarimeter. The new assistant would be required to conduct distillation of fat residues within a few feet of unprotected gas burners and his protection would be a tetrachloride pump suspended within reach.

In the course of time, I had the opportunity of supervising the construction of two laboratories and found room for a small distillation room made with asbestos board. This ensured the safety of chemists and technicians for whom I was responsible.

On arrival in New Zealand, I had to supervise the construction of a laboratory, and interviewed the Excise and Customs Department in order to obtain a permit or licence for distilling ethanol. I was told that a permit was not necessary for recovery of small quantities up to two gallons a month. No supervision was made, and much larger quantities of ethanol could have been rectified if I had desired.

With regard to fire hazard, I was informed on good authority at a later date that this unofficial permission by the Customs Department prevented the co-operation of the Department of Labour in regard to regular inspection for fire risks.

A government laboratory in New Zealand had been accustomed for over five years to utilize the same side room for Kjeldahl distillation and redistillation of solvents; one operation would be conducted when the other was not required.

This arrangement proved satisfactory until a new technician lighted the gas burners of the Kjeldahl battery; petroleum ether was being distilled and the distance of 4 ft to 4½ ft between the benches was found insufficient to prevent a fire. The negligent operator escaped injury but another chemist was burnt.

It may be assumed that this laboratory was never visited by inspectors looking for fire hazards. May I suggest that the Council of the Institute make representations to the Department of Labour and request more thorough supervision of laboratories for fire hazards.

W. Rest Mummery
Dairy Research Institute, Palmerston North

REVIEWS

EDUCATION IN CHEMISTRY, Vol. 1, No. 1, January, 1964. Published by the Royal Institute of Chemistry, London. Annual subscription (4 Nos.): 40s. post free; R.I.C. members, 30s.

This is the first number of a quarterly journal published "with the avowed aim of improving the teaching of chemistry at all levels". The teaching chemist, sensitive to the increasing numbers of increasingly heavy journals, will want the answers to some obvious questions. This quarterly does not clash with existing periodicals; its coverage is sufficiently broad to match its professed purpose while it gives good value to the teacher at any particular level of chemistry teaching. There are articles on general aspects of chemical education, others on molecular models, chemical bonds, molecular geometry and thermodynamic cycles. Contributors are drawn from the schools and the inspectorate, from polytechnics and universities, and the articles are, in general, both usefully long and attractively concise. There are reports on teaching developments from a number of countries and there are book reviews.

It is encouraging that the editorial reveals an awareness of the interests of other countries, from Europe to Australia, and we may therefore expect that the journal will avoid any parochial preoccupations. There is little doubt that *Education in Chemistry* will be welcomed by teachers; it also has much to offer other chemists.

—J.V.

THE BIOCHEMICAL BASES OF PSYCHOSES, or The Serotonin Hypothesis About Mental Diseases. By D. W. Woolley. Published by John Wiley and Sons, New York. 1962.

Freudian concepts which have dominated the study of mental disorders for fifty years have contributed little to the successful treatment of the majority of cases of frank psychiatric disturbances.

Clinicians know well that imbalance of blood chemistry can produce aberrations of brain function ranging from confusion and illogicality to gross personality changes. Chemical analyses show clearly that small alterations in blood levels of, for example, potassium or ammonia can produce such effects. Personality changes are often associated with alterations in the level of circulating hormones. It is therefore not at all extraordinary to suggest that psychiatric disorders such as manic-depressive psychosis and schizophrenia could be due to chemical aberrations. Jung himself considered the aetiology of schizophrenia to be a dual one, involving both chemistry and psychology.

Professor Woolley's work on antimetabolites is the basis of his serotonin hypothesis. Experiments on humans give the following evidence. Serotonin is a substrate for monoamino-oxidase. When an inhibitor of this enzyme such as the drug Marsilid is given to patients suffering from depression, the depression is relieved. Increased levels of serotonin accompany the relief. When excited patients are given Marsilid they become worse. Conversely, excited patients are calmed by tranquillizing drugs such as reserpine and chlorpromazine which act as antimetabolites or antagonists of serotonin, interfering with its activity and reducing its level. Similar effects of these drugs are seen in normal people. Hallucinogens such as LSD and the ergot alkaloids fit into the theory because their chemical structures are related to that of serotonin.

Several chapters, showing how the mental changes and defects associated with inborn errors of metabolism and faulty hormone metabolism fit the theory, add little. The serotonin theory is too sweeping. The author, obviously aware of this, repeatedly remarks that this presents one view of the whole field through one keyhole. It is, nevertheless, an important view, because it shifts the focus from "baleful influences of childhood" to the area that may well contain the answers to many psychiatric problems — the chemistry of brain function.

—J.M.

SURFACE ACTIVE SUBSTANCES CONGRESS

The IVth International Congress on Surface Active Substances will be held in Brussels, from September 7 to 12, 1964. The works of the Congress are divided into three sections:

> *Section A* (subdivided into four groups) under the directorship of Professor Dr Ing. F. Asinger (Germany): "Chemistry of Surface Active Substances", during which some 50 papers will be delivered.
>
> *Section B* (subdivided into six groups) under the directorship of Professor Dr J. Th. Overbeek (Netherlands): "Physics of Surface Active Substances", during which about 150 papers will be delivered.
>
> *Section C* (subdivided into seven groups) under the directorship of Professor C. Paquot (France): "Use of Surface Active Substances", during which some 100 papers will be delivered.

Readers interested in the Congress may obtain circulars and registration forms upon application to:

General Secretariat of the IVth International Congress on Surface Active Substances, 49 Square Marie-Louise, Brussels 4 (Belgium).

CARBON MONOXIDE DETECTOR

Merzli Ltd., London, have announced the introduction in Denmark of a detector plate to give warning of hazardous concentrations of CO. This detector, invented by Asger Bongsgaard of the State Crime Detection Laboratory, Aalborg, consists of a plastic plate with an insert containing palladium chloride suspended in silica gel of the same yellow tint as the plate. In the presence of CO the palladium salt is reduced and the insert turns grey or black, depending on the gas concentration. CO at 0.01% is detected in less than 15 minutes, at 0.02% in 5 minutes, and at 0.05% almost immediately. The sensitive disc is regenerated by exposure to non-contaminated air, for from half to 3 hours, depending on light and temperature, and can be used several times. A report from the Government Testing Laboratory, Stockholm, supports these claims but adds that H_2S and nitrous gases interfere with the test. (*Note*: The M.A.C. for CO, according to the R.I.C. *Handbook of Toxic Agents*, is 100 p.p.m. = 0.01%. Pieters & Creyghton (*Safety in the Chemical Laboratory*) conclude, from data on the relation between CO concentration and proportion of hemoglobin inactivated, that concentrations of 0.01% are harmful and levels over 0.05% are dangerous.)

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POTASSIUM HYDROGEN PHTHALATE pH STANDARD

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The primary pH Standard[1] is an M/20 aqueous solution of pure potassium hydrogen phthalate, which has been assigned a pH value of 4.000 at 15°C. Potassium hydrogen phthalate specially purified by B.D.H. has been tested as a Standard by the N.C.L. at four different temperatures and has been certified as satisfactory; the results of the tests are well within the limits imposed by B.S. 1647:1961.
Each 100g pack of the colourless crystalline material carries a leaflet describing the Laboratory's methods of testing, its results, and the criteria it has applied. Further copies of the leaflet will be sent free on request.

1. British Standard 1647:1950 and 1961

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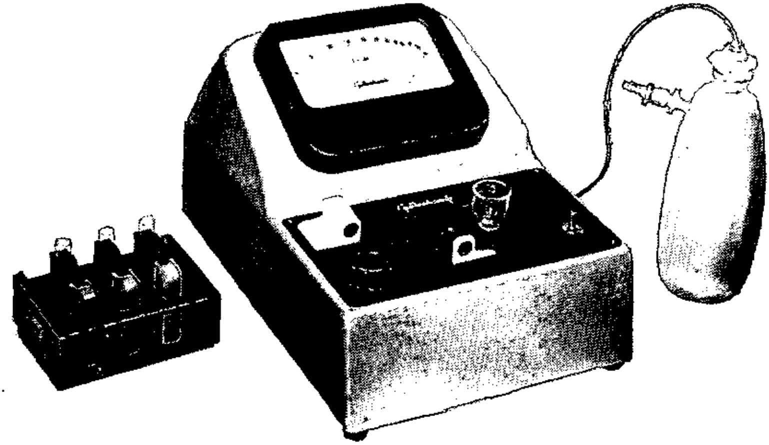
The British Drug Houses Ltd.
B.D.H. Laboratory Chemicals Division,
Poole, England



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