CHEMISTRY IN NEW ZEALAND

JOURNAL OF
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OF CHEMISTRY

Vol. 37, No. 1, February, 1973

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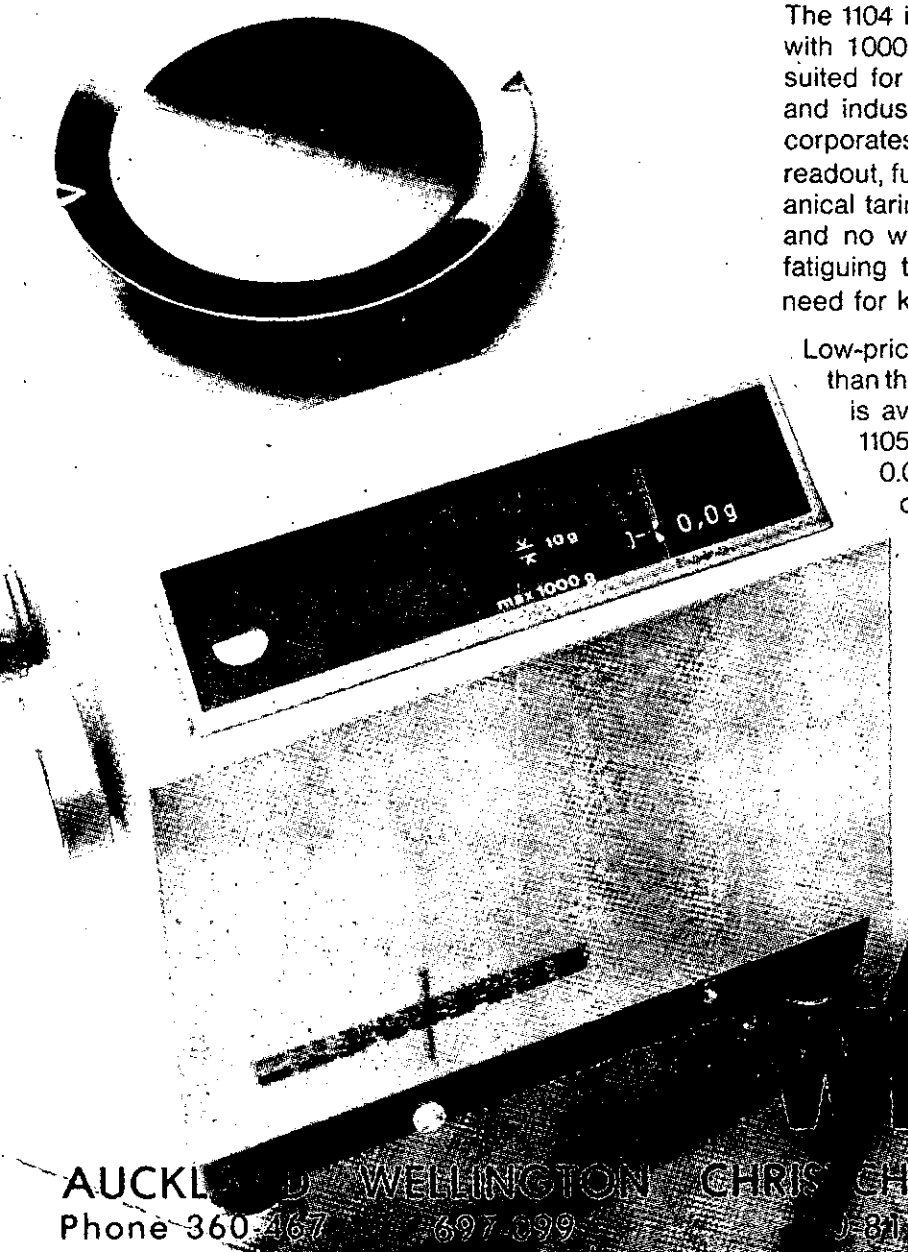

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CHEMISTRY IN NEW ZEALAND

Journal of The New Zealand Institute of Chemistry

Vol. 37, No. 1, February 1973

Published bi-monthly by the New Zealand Institute of Chemistry Inc. (P.O. Box 250, Wellington)

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Printed by David F. Jones Ltd., Wellington.

COVER

Copy of "The Book of Tobias". 20" x 24", Pencil on pasteboard. Collection: Mr. H. C. Rile Jr.

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The Journal of the N.Z. Institute of Chemistry has an audit circulation Certificate of New Zealand Advertisers. Latest audited circulation (March 1969) 1150.

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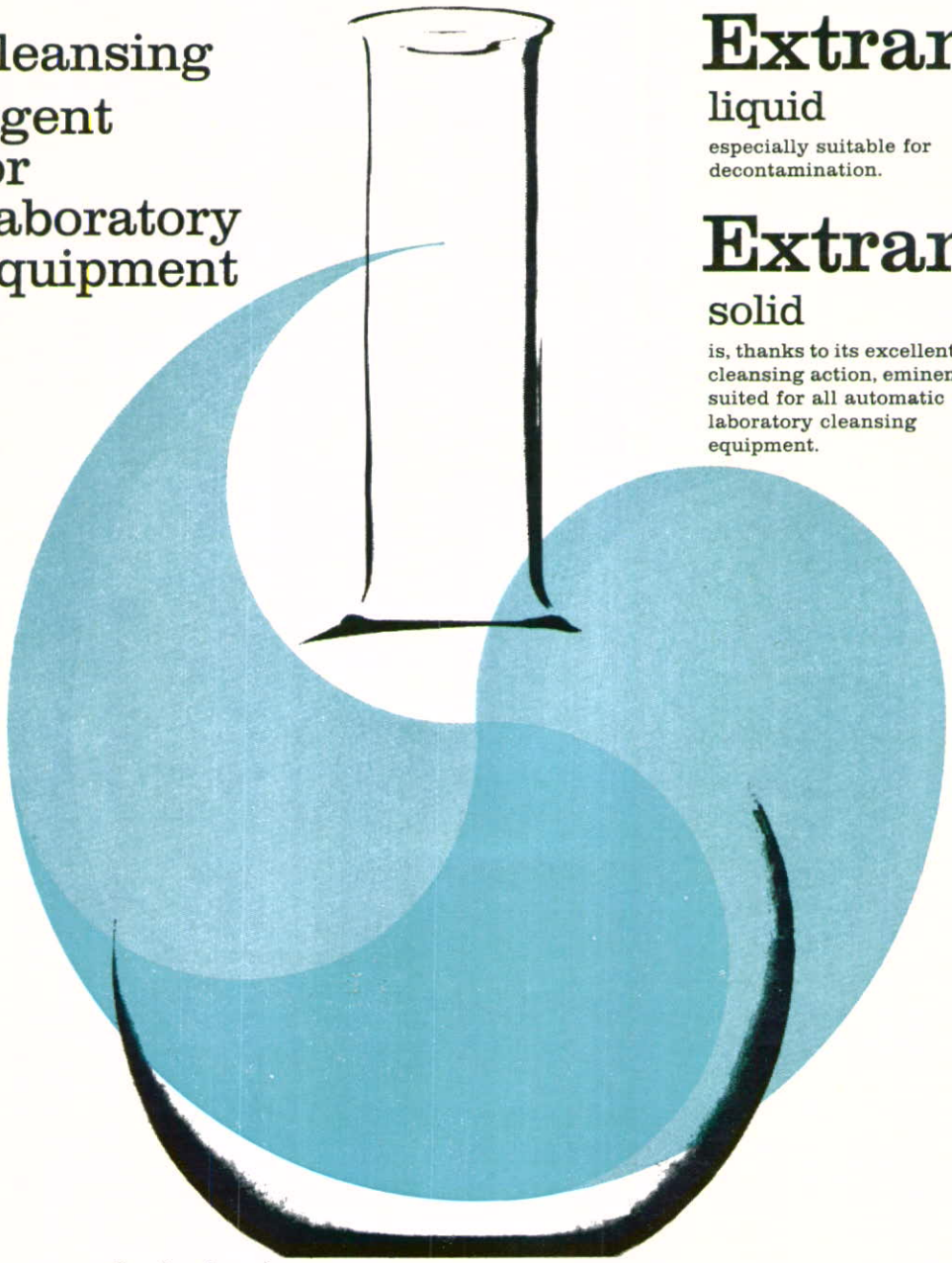

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Editorial

ALL CHANGE

With international changes to SI units and New Zealand's change to the metric system comes the need for changes in the *Journal*. The next issue (April) will be of different page size; and from then on metric symbols and SI units will be required in articles wherever possible.

The New Zealand Metric Advisory Board was set up in 1969. It established a number of Section Committees whose functions are to identify problems, prepare timetables and co-ordinate metric conversion in their respective sections of the economy. The changeover is a much more extensive one than was the change to decimal currency, so it is being spread over a number of years. Changeover should be completed in 1976.

Publications of the D.S.I.R. and Agriculture Department introduced the use of metric units at the beginning of 1972. Education Department publications have used them in many areas for some time. One New Zealand publishing firm uses metric units in its educational publications, but other publishers seem to be unaware of the implications of metrication (new word!).

The conversion of the printing and allied industries was planned to start in 1972 and to be completed by January, 1974, in time to serve other industries which will be starting to change by that date. Until printers are fully metricated, there will be problems of spacing, and of symbols for which, as yet, no fonts are available.

Thus authors submitting articles for publication should use the SI system wherever possible, and take great care with symbols, spaces, capitals and columns of figures. Particularly, they should be aware of the problems of interpretation than can occur with handwritten or typewritten texts. For example, the letter 'ell' and the figure 'one' can be easily confused.

The Government Style Book is to be revised. Meantime the Standards Institute publications provide the reference standards for metrication;

N.Z.S. 6502 *Metrication Factors and Tables for Conversion to SI Units* $4.50 posted.

N.Z.S. 6503/1 *Metric Units for Specialised Fields. Introduction.* 50c posted.

N.Z.S. 6503/82 *Metric Units for Specialised Fields. Publications.* 50c. posted.
(This deals with the correct use of symbols for typing, printing and telex).

The latter two are temporarily out of print but should be available by the end of March, 1973.

To help keep New Zealand in step with other countries, the Director of the Standards Institute, Mr. G. H. Edwards is to attend the inaugural meeting of the Pacific Area Standards Congress in Honolulu in March. This is an exploratory meeting to try to get uniformity of thought and action in the Pacific basin countries.

Further information for Institute members will be published as it becomes available.

SOME PHYSICO-CHEMICAL ASPECTS OF TRIBOLOGY IN INDUSTRY

by J. M. Thorp, B.Sc. (Hons.) Lond., Ph.D. (London), F.N.Z.I.C.
(Auckland Industrial Development Division, D.S.I.R.)

(A lecture given to the Auckland Branch of the Institute of Physics)

The Renewed Interest in Friction, Lubrication and Wear (Tribology)

Up to a decade or so ago Man was able to get away with poor lubrication and minimal attention to problems of friction and wear. He simply paid for the replacement of worn parts and for the large proportion of power wasted in overcoming friction. Add to this the production losses due to the shut-down periods, labour costs and the inconvenience caused and it becomes of obvious economic importance to reduce friction and wear.

Economic reasons account for part of the renewed interest in these topics, now collectively given the name Tribology (from the Greek 'tribos' for 'rubbing'). largely however, progress and new technologies have forced attention on the problems associated with rubbing surfaces since success largely depended on their solution. Progress involves the use of higher speeds, greater work loads, often with bearings in a gaseous or chemical fluid environment, or in a vacuum, or bombarded with radiation, or at temperatures above or below that where conventional mineral oils are effective. The use of new materials, for example, depends on whether they can be machined or formed without scoring, seizing or damaging the tools. This frequently necessitates a search for a new cutting lubricant and more wear-resistant tool surfaces. Space technology has accelerated research in solid film lubrication, since fluids can no longer be used to lubricate moving parts in space. Nuclear technology has had to solve problems involving nuclear radiation, inaccessible bearings, liquid sodium pumps and so on.

Man in the future can no longer get away with poor lubrication, inadequate materials and bad design, at the speeds he wants to use, with the loads he plans to carry and in the hostile environments which often surround the moving interacting surfaces.

The Complex Nature of the Interactions of Surfaces in Relative Mation.

As soon as one surface rubs, slides or rolls over another, complex changes occur in the surface films, in their underlying substrates and in the lubricant itself. Some of these changes are initiated by the frictional heat which depends on the load, the relative sliding speed, the surface roughness, the surface conductivity and whether a copious supply of lubricant-cum-coolant is available. The increase in temperature due to friction may cause a change in the chemical composition of the surfaces. Thus a metallic oxide film may be built up on the surfaces or a sulphide film may be formed from sulphur-containing break-down products in the oil. An increase in temperature also causes physical and chemical changes in the lubricant, and changes in the mechanical properties of the surfaces and substrates. Sliding may cause a preferred orientation of surface crystallites, in which case a reduction in friction may occur if the crystallites are of lamella structure which shear easily.

The Concept of Tribology in the U.K.

The economic importance of friction and wear problems in british industry was illustrated with considerable effect in a British White Paper published in 1966. It was estimated that about 1000 million dollars a year could be saved if british industry paid more

attention to friction, lubrication, wear, bearing design and related topics. It was emphasised that the study of the interdependent interactions between sliding surfaces involved physics, chemistry, metallurgy and engineering and that, in fact, the multi-disciplinary nature of this field had hampered progress.

Recommendations made in this report have now been put into action by the British Government and today there is no doubt that british industry is beginning to save part of this annual $1000 million. New Tribology education programmes have been introduced at all levels from the factory shop-floor to university post-graduate courses. The new name 'Tribology' has been defined as 'the science and technology of interacting surfaces in relative motion and the practices related thereto'. M.Sc. Degrees in Tribology are awarded at Leeds and Salford Universities, and there are trade and school certificates in Tribology. Industrial research units have been established at Swansea, Leeds and Southampton Universities and a Tribology Research Centre has been set up at Risley.

British Tribology Casebooks

The success of this British Government-boosted venture is substantiated by the many reports of industrial innovations and savings already incurred.

British Railways, for example, are now replacing metal gears with nylon and carbon-fibre reinforced plastics for some duties in locomotives. Metal gears will fail in the event of loss of lubrication whereas nylon gears run without lubrication so that they are much more reliable. In addition, the manufacturing costs of nylon and reinforced nylon gears are considerably lower than for steel gears.

The search for a less-sparking material to replace the traditional cast-iron brake blocks of locomotives, which wear heavily and constitute a fire hazard since they produce a shower of sparks on braking, has led to a cast-iron containing 3 per cent phosphorus. This new material sparks less, wears less and gives comparable breaking performance to the traditional material. Before the use of the new blocks a train could be out of service every third day for brake block maintenance.

A systematic approach to lubrication requirements, with the bulk purchase of a reduced number of oils and greases, and the use of planned greasing and oil route cards enabled one company to save 10,000 dollars each year on labour and lubricant costs alone.

Another larger firm installed an automatic centralised lubrication system, with a controller to inject the correct amount of oil to the various lathes and machines at the correct time intervals. The cost was 40 dollars per machine and there have been no breakdowns in over three years. Previously, lathes were breaking down every few months, either due to under-lubrication, over-lubrication or wrong lubrication.

Bacterial contamination of oil can be another expensive problem and also a health hazard. The British Aluminium Corporation use an oil/water emulsion as a lubricant and coolant in hot rolling aluminium. By eliminating bacterial contamination a direct saving of over 2000 dollars a year was made on the cost of emulsion and filters alone.

There are many more published cases of savings through good tribological practice, but since the Industrial research units undertake sponsored work from industry, there are far more cases, with even greater benefits, that remain unpublished, allowing these industries a lead over their competitors.

International Interest in Tribology

This renewed interest in friction, lubrication and wear is international. The U.K. is, in fact, a late starter in the tribological race, although it coined the new name Tribology, now adopted throughout the world. In East Germany a specially trained lubrication engineer was appointed to each factory long before the U.K. became seriously aware of such needs. The U.S. is especially noted for

much of the work involving friction in space. New Zealand is not in the race at all! Yet our isolation, our unique climate and conditions, and our economic state all point to the fact that we cannot afford to miss the 'Tribology Bandwaggon'!

Tribology in New Zealand

New Zealand already has the necessary qualified staff in the universities, technical colleges and schools. Some of the necessary research facilities are already available in the Engineering Schools and Physics and Chemistry Departments of the Universities and in D.S.I.R. laboratories. Awareness and organisation are the missing links that could enable New Zealand industry to start saving their proportion of those wasted dollars.

A one-man start has been made at the Auckland Industrial Development Division of the D.S.I.R. The projects already undertaken within the last 2-3 years illustrate the need for this type of work. However, real progress will only be made when the type of education schemes launched by the U.K. are introduced. Awareness of the economic importance of tribology and the recognition that friction and wear problems *can* be solved by an efficient tribology research unit would give New Zealand industry the boost it so badly needs.

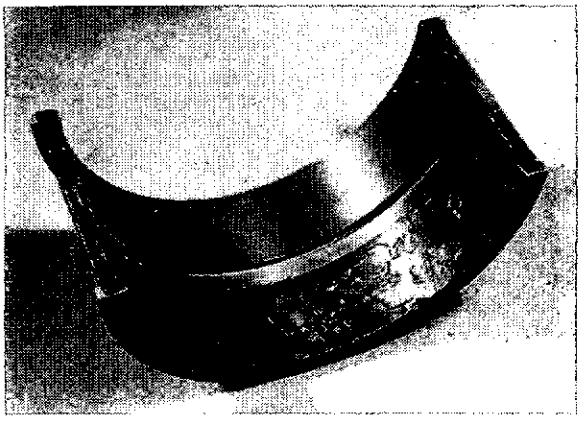
A Selection from the A.I.D.D. Tribology Casebook*

Many of these cases illustrate bad tribological practice that could have been avoided; bearing failures due to the use of incorrect materials, overloading, corrosion, oil contamination and unsuitable grease. There is little excuse for this as the know-how is readily available. Tribology education could remedy such expensive mistakes.

Examples:

(a) A worn high leaded-bronze bearing (containing 20 per cent lead) from a marine engine was replaced by a harder tin-bronze bearing containing only 1 per cent lead. The steel shaft seized on the new bearing within

Plates



1. Marine engine bearing: a typical fatigue failure.

2. Close up of the fatigue failure of the white metal overlay supported on a steel backing.

*Auckland Industrial Development Division.

three minutes of starting the engine. A high leaded-bronze bearing material consists of lead pockets dispersed throughout a copper-tin matrix. The matrix provides the strength and conducts the heat from the surface. At the surface the lead globules become smeared into a low-shearing continuous film which acts as a lubricant and reduces friction and wear. The material has, in fact, built-in lubricant reservoirs.

(b) Plates 1 and 2 show typical bearing wear due to fatigue, in this case due to misalignment causing serious overloading.

(c) Plate 3 illustrates a roller bearing failure from a wood-chip drier caused by the failure of the grease at the operating temperature of 175°C. The grease (centre of Plate 3) had blackened and finally solidified, wrecking the whole bearing. A new bearing cost 300 dollars and 30 hours production time was lost.

(d) A project undertaken for the Ministry of Works was an investigation of the frictional behaviour of steel-backed P.T.F.E. rubbing at low speed, under heavy load, against polished stainless steel. Such bearings are commonly used as bridge expansion bearings, where very slow movements of up to one or two inches are accommodated. No lubrication is required and no corrosion occurs. Such bearings are now in use in several Auckland motorway bridges.

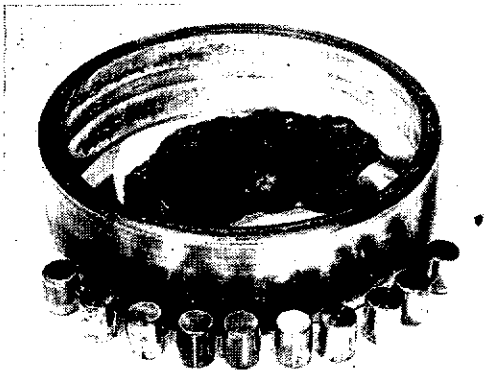
(e) Lubrication problems at high temperatures, where oil is no longer of use, are common and range from the lubrication of conveyor chains or trolleys which pass through furnaces to the lubrication of dies in the extrusion of hot aluminium billets. The use of solid film lubricants such as graphite, or molybdenum disulphide, is frequently the answer in such cases, depending on the temperature and environment. However, graphite requires the presence of adsorbed water or other contaminant molecules, apparently to reduce the attractive Van der Waal forces between the crystalline layers, before easy shearing and low friction results. Thus graphite exhibits a high coefficient of friction in a vacuum, but is effective in humid conditions. In contrast, MoS_2 is effective in a vacuum but the friction increases in a moist environment. The presence of adsorbed molecules, in this case, is considered to reduce the adherence of MoS_2 to the surface.

One such project was an investigation of the possibility of lubricating the dies through which hot aluminium is extruded. The extrusion of aluminium billets at about 500°C through lubricated dies uses a large amount of power merely to overcome the surface friction. Since MoS_2 oxidises at 400°C, graphite lubrication appeared an obvious possibility.

The compression of a hot aluminium ring between two heated tool-steel platens or dies was used to simulate extrusion. The coefficient of friction could be estimated by measuring the diameter of the hole. With high surface friction, as with unlubricated conditions, the ring material flows inwards, towards the centre, during compression, and the hole becomes smaller. With low surface friction the hole becomes larger.

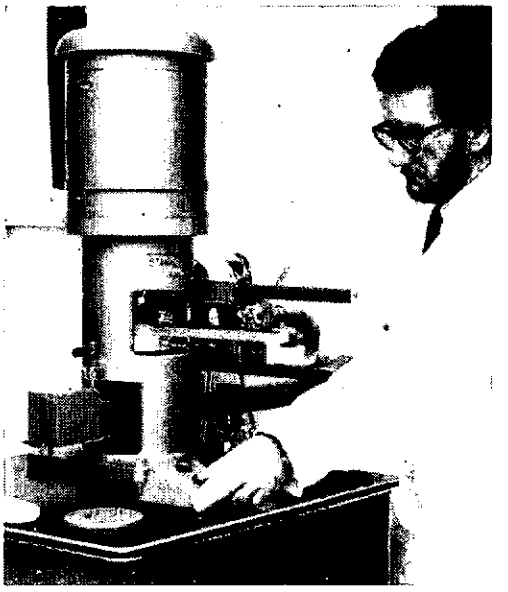
Our experiments showed that at 400-500°C graphite lubrication of the steel dies reduced the coefficient of friction for aluminium against tool steel from 0.4 to 0.09. It should thus be advantageous to similarly lubricate the dies used in the hot extrusion of aluminium.

(f) In certain cases where heavy loads and low speeds cause lubrication problems, considerable benefit may be obtained by using oil which contains MoS_2. It is evident, however, that the mechanism of MoS_2 lubrication is still not clearly understood, in spite of the large amount of literature on the subject. Further work is currently being carried out on a 4-ball extreme pressure (E.P.) lubricant test machine (Plate 4) in an attempt to elucidate this mechanism further. This machine is able to subject a lubricant to pressures up to half a million pounds per square inch by applying a load on the very small area between contacting steel balls. Three contacting steel balls are held stationary in a container (shown in Plate 5) which



3. Grease solidification at 175°C wrecked this roller bearing from a wood-chip tumbler-drier machine.

5. The torque arm and lubricant container in which three ½in. dia. steel balls are clamped by means of a lock nut (not shown) and a conical ring. The fourth ball is shown in the chuck which is attached to the motor drive.



4. The 4-ball extreme pressure (E.P.) lubricant test machine.

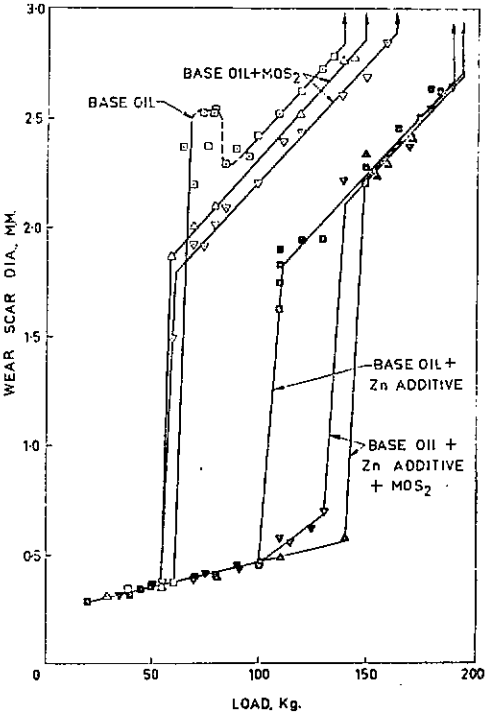


Fig 1. A plot of the average wear scar diameter against the applied load for a straight mineral oil and when zinc dialkyldithiophosphate and molydbenum disulphide are added to the base oil, both separately and together.

MoS2 ADDITION TO MINERAL OIL

is filled with the test lubricant. The fourth ball is held in a chuck attached to the drive of an electric motor and is rotated under a known load at a speed of about 1500 r.p.m. in the cavity formed by the three underlying balls. During a run the frictional torque on the balls in the cup is recorded. After a fixed time interval (usually 60s) the machine is stopped and the average diameter of the roughly circular wear scar made by the top ball on each of the three underlying balls is measured. The average diameter of all three scars is taken as a measure of the wear.

The average wear scar diameter is plotted against the applied load to give the characteristic curves illustrated, in Fig. 1., which are given by a straight refined mineral oil alone and with zinc dialkyl dithiophosphate (a common anti-oxidant and anti-wear additive) and molybdenum disulphide added, both separately and together. All the curves show a characteristic transition from mild to severe wear at a critical load.

In the four-ball test, conditions are severe enough for the surface films to play a predominant part in preventing metal-to-metal welding of the contacting asperities. In the mild wear region physically adsorbed surface films protect the surfaces. At the transition point the load is able to disrupt the film, and severe wear accompanied by an increase in friction occurs. Frictional heating now becomes high enough to promote chemical reaction between the exposed metal and the environment. Thus continuously formed chemisorbed films, which may be metal oxides from reaction with the air or metallic sulphides, phosphides or chlorides, from reaction with chemical breakdown products in the lubricant, provide protection from seizure in the severe wear region. Eventually a sufficiently high load is reached where the frictional heat is high enough to melt the contacting metal surfaces and the four balls weld together. (An automatic cut-out switch stops the motor at this point).

The straight mineral oil is characterised by an abrupt transition from mild to severe wear at a relatively low load. This is because the adsorbed surface films consist mostly of saturated paraffin molecules which are not held strongly on the metal surfaces and are easily disrupted and swept aside at low loads. Above the transition point an oxide film and possibly other chemisorbed films prevent seizure.

When MoS_2 is added to the straight mineral oil the transition load is little affected, yet above the transition point, in the severe wear region, MoS_2 is effective in reducing the wear. This infers that MoS_2 only adheres strongly to exposed bare metal surfaces after the disruption of the physically adsorbed paraffin films.

When zinc dialkyldithiophosphate was added to the base oil, the load could be doubled before a transition to more severe wear occurred. The zinc additive is strongly adsorbed on metal surfaces, and thus a high load is necessary to disrupt the film. Above the transition load the frictional heat becomes sufficient to decompose the sulphur-containing zinc compound and it is thought that a low-shearing protective metal sulphide is formed on the surface.

When MoS_2 is added to the oil which has been treated with the zinc additive it appears that the MoS_2 is now able to adhere to the surfaces in the mild wear region, since the transition point is extended, but on the other hand, does not adhere to any extent at higher loads, where the curves approximately coincide. This can be explained by assuming that the MoS_2 particles can adhere to the adsorbed zinc dialkyldithiophosphate molecules, thus forming a thicker protective double layer on the surfaces. Above the transition point the chemical reaction between the exposed metal and the active sulphur from the decomposition of the zinc additive predominates, resulting in the formation of a surface metal sulphide film. The presence of MoS_2 now has little effect.
(g) The four-ball E.P. lubricant test machine is also currently being used to determine the extreme boundary properties of lubricants used in metal working, such as wire drawing, extrusion, rolling, forging and for-

ming, where the severe frictional conditions prevent fluid lubrication. The lubrication mechanism is thus dependent on the presence of suitable strongly adsorbed or preferably chemisorbed films on the metal work-piece and tool surfaces.

A current project is the investigation of lubrication in sheet metal forming in which a sheet metal blank is forced into a die by a punch, to form hollow products such as sinks, baths, saucepans and so on. This type of forming is known as deep-drawing. At present there is no 'bench' test for deep-drawing lubricants, the only method of testing being uneconomic production trials. It is hoped that it will be possible to determine the relative merits of deep-drawing lubricants by using the four-ball tests.

The load-wear and load-friction curves for a number of such lubricants have been determined. These same lubricants will then be used to deep-draw cylindrical test cups from blanks of fixed diameter. The maximum drawing load required to draw a cup gives a measure of the lubricant efficiency, the most efficient lubricant requiring the least drawing force. It is then hoped that four-ball test conditions can be found so that the order of lubricant merit correlates with actual deep-drawing performance.

(h) Finally brief mention of a project undertaken for a nylon manufacturer to investigate the breakage of nylon yarn during a drawing or stretching process, in which the yarn was passed over a series of 14 steel rolls. The last seven rolls moved at a faster rate than the initial seven rolls, causing plastic strain of the nylon yarn on the seventh roll. Considerable breakage occurred at this point with a particular fine-filament yarn.

Friction tests were performed with a length of stationary yarn lapping a roll, which was rotated at a known speed. A known load was attached to one end of the yarn and the other end was attached to a force gauge which recorded the tension. The coefficient of friction, (which could be calculated from the well known Capstan equation) at any instant, depended on the roll speed, the load, the surface finish of the roll and the chemical nature and viscosity of the applied aqueous lubricant solution.

The viscosity of the lubricant solution and the roll surface finish were found to be important factors and appropriate changes were recommended which largely reduced the nylon breakage.

Future Academic Contributions to Tribology

In the case of sliding surfaces both friction and wear obey similar laws. Thus provided the nature of the surface does not change, the volume of wear debris removed in sliding a distance L is given by $V = KAL$, where K is a constant and A is the true area of contacting surface asperities. The frictional force is given by $F = As$, where s is the tangential shearing stress of the junctions formed between the contacting asperities. The true area of contact is difficult to measure. Theoretically it is known that A should be proportional to the load whether the deformation is elastic or plastic, hence the wear rate and friction should be directly proportional to the load, as given by the macroscopic empirical laws.

Until both A and K can be predicted from a knowledge of the basic properties of the materials involved, however, it cannot be said that we have a theory of friction and wear. The true areas of contact A and the K factor are both microscopic concepts. Thus any theories explaining the behaviour of sliding surfaces must provide some explanation of A and K in terms of microscopic factors such as crystallography, the chemical composition of the surfaces, their supporting substrates and the wear debris produced, and so on. Thus a direct microscopic approach is now required, using, among other things, the techniques of electron microscopy, electron probe microanalysis, electron diffraction and X-ray diffraction.

The Chemistry, Physics and Engineering Schools of the universities can thus make considerable contributions to tribology, which will be of vital importance to industry and transport.

A FISHY TALE

(Or the One That Did Not Get Away)

by H. Keyzer Ph.D.
Chemistry Department, Victoria University of Wellington

Practices from folklore and old wives' tales cannot always be dismissed as arrant nonsense since many have been scientifically validated and have formed the basis of a significant fraction of modern medicinal chemistry[1]. A striking practice in modern science with a parallel in antiquity is today's penicillin and the widespread use of bread moulds on infected wounds by the Egyptians about 3000 B.C., i.e., at the time of Imhotep, physician to the Pharaoh and inventor of the pyramids. A remarkable instance of medicinal chemistry which should delight any fisherman of heroic proportion is the curing of blindness of Tobit with bile from a pelagic monster as mentioned in the Apocrypha[2].*

Horral[3] tells us that the earliest mention of bile (gall, choler) is found in an Egyptian sacerdotal papyrus about 1500 B.C. It signified poison, an idea which held sway until relatively recent times. Hippocrates, about 400 B.C. based his entire system of medicine on the assumption that bile was the probable cause of all disease. Galen, about 150 A.D., re-established this notion, and his works were the law, deviation from which was punishable even by death, until Paracelcus and van Helmont (16th, 17th century) disclaimed the myth.

The story of Tobit[4] (there are two people with the same name in the original tale—to avoid confusion, I shall call the father Tobit, and his son Tobias) was apparently written by an orthodox Jew that his expatriate people might keep faith and for the conversion of gentiles. It was probably written in the 2nd century B.C., during the reign of Antiochus IV, who forbade the burial of slain Jews. Much controversy surrounds its origin. Nevertheless, it is clear that the medicinal use of bile was quite contrary to the then accepted tenets of medical lore, a strange method of proselytizing, to say the least, unless the author of Tobit had a model to work from. Whatever the historical or literary conflict, let us confine ourselves to the chemical and medicinal aspects of the ophthalmological adventure in this story, which all appear to yield to correlation with modern observation, despite heavy use of conjecture forced upon investigators of folklore and ancient practice.

One midnight, Tobit, weary from the illicit burying of slain Jews, cast himself against the wall of his house. While sleeping, freshly excreted dung from a swallow's nest fell on his eyes and he was made blind[4]. Presumably the prurient matter caused infection and led to corneal damage, normal *sequela*[5,6] to chemical irritation and abrasion when proper first-aid is not immediately to hand (quite likely in times when oil lamps, or similar, were the only forms of illumination available). The infection appears consonant with fungal origin (mycotic keratitis). Experiments[7] with a number of filamentous fungi, e.g. *Aspergillus, Fusarium,* and *Curvularium sp.,* carried into corneal abrasion, causes development of a white plaque at the site of trauma. The cornea is not usually vascularized. These fungi are ubiquitous and can be found in air, soil, water, foodstuffs, vegetable or animal and can also be isolated from almost all body orifices. The details of his cure, effected a considerable time later, follow.

Tobias, the son of Tobit, set out on a financial family matter. One evening[8] he entered the Tigris to wash his feet and was set upon by a monstrous fish intent on devouring him. Following divine instruction, Tobias took the fish by the gill and drew it up on land. (See

* Note: Modern usage of the term Apocryphal has an imprecise meaning[2]. In old times it signified "Hidden Work".

cover)*. On further instruction, Tobias laid up the fish's heart,** gall and liver, these being the basis of useful medicines. It is unfortunately not clear whether gall refers to the entire gall bladder or merely its contents.

Purified and enriched ox bile[9] was once a significant weapon in the therapeutic arsenal of the surgeon. Dried pig bile[10] was also used efficaciously. Specifically, bile salts[11] were commonly employed in corneal treatment to decrease surface tension and increase the permeability of the cornea to drugs. Returning to our tale: after a number of adventures Tobias returned home. He took the gall[12] and with it anointed his father's eyes, "blind with the white speck". After about half an hour a white skin resembling that of an egg exuded from the eyes.*** After removal of the skin, presumably the thin keratitic plaque loosened by the detergent action of the bile salts, Tobit regained his sight, having been blind for four years. A thin, superficial corneal scar may often be removed by scraping[13] (or "finger excision") and this method is best applied to calcified opacities such as those following keratitis, restoring vision, perhaps somewhat distorted, providing of course, the remainder of the eye is intact.

There is another aspect of this tale worthy of attention. It involves anti-inflammatory corticoid therapy. Of these steroids the anti-inflammatory hydrocortisone (cortisol) and its derivatives are *sine qua non* in ophthalmological treatment[6].

Bile, usually retains in solution all the substances passed into it by the liver cells[14], e.g. inorganic ions, fatty acids, free cholesterol, phospholipids, alkaline phosphates, other enzymes, bile salts and other compounds, generally made ready for excretion or for assisting digestion. The gall-bladder concentrates these substances as much as ten-fold[15]. The liver[16] is the major organ for metabolizing circulating blood steroids and terminating their biological activity. The lipid-soluble steroids are converted to more polar, water-soluble metabolites and conjugated with glucuronic acid, sulphuric acid and other substances. In man, most of the metabolites of steroid hormones finally appear in the urine, after biliary excretion and resorption in the gut. Minute amounts[17] of hydrocortisone, the major adrenal glucocorticoid in man, found in all tissues and body compartments, occur in hepatic secretion. Little enters the bowel via the bile but detectable quantities do. Peterson[18] gives the solubility of hydrocortisone in saline (0.15M) solution to be 200μg/ml, which suggests that in the highly dispersive bile medium higher concentrations of this normally lipid-soluble material could well be achieved. Peterson *et al* , using radioactive hydrocortisone, showed that in normal man about 5 per cent of the administered dose appeared in the bile. Three per cent of the administered dose was recovered from faeces, suggesting that the bile was the major, perhaps the sole source of the faecal product. It is said that much of the free steroid secreted into the bile is re-absorbed by the lipid structure of the bile duct membrane[19].

Differences in steroid excretion must of course be expected for different species under different circumstances, as numerous experiments have indicated[18]. 0.2-1.1 per cent of injected hydrocortisone was recovered from sheep's bile[20]. Certain forms of hepatic dysfunction delays metabolism of hydrocortisone [16,17]. Stress generally increases plasma and bile levels of hydrocortisone, e.g. as in guinea pigs injected with polysaccharide from *Klebsiella pneumonia*[21]. One worker[22] who found normal sheep bile to contain 15μg/l,

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* The author has allowed himself some artistic licence with the rendering of the fish.

** Sara, Raguel's daughter, was Tobias's future wife (detail, fish's eye). She had been given to seven husbands in succession but remained a virgin. Each husband died, destroyed by a demon which possessed her. The smoke generated by placing a piece of the fish's heart or liver on burning coals was divinely claimed to drive out all maner of demons. The latter was used to exorcise the demon?

*** Therefore not cataracts which require corneal incision for removal.

showed that the bile of starving sheep contained 600μg/l. Fish (coho salmon and rainbow trout)[23] subjected to non-specific stress, showed increased hydrocortisone levels remaining high long after removal of the stressor.

It is not beyond the bounds of reason to suppose that the fish which attacked Tobias was hungry, or that it died under acute stress. Hence it ought not to stretch credibility too far to assume that more than negligible amounts of hydrocortisone may have been present in the gall of that fish. Moreover, the gall constituents had time to concentrate by evaporation of fluid in the hot climate while Tobias was engaged upon his marital and financial adventures. Thus, in addition to the wetting action of the bile salts, a palliative bonus of hydrocortisone may well have played a role in preventing post-operative scarring similar to its function in the emollients of modern ophthalmological practice[24]. Whether the role of anti-inflammatory bile constituents was more than marginal can, of course, not be determined, particularly because the species of fish involved is not known, nor have all the constituents of bile from different species been classified, let alone determined[14].

It has been noted, however, that continued instillation of ox or hog bile into the eyes of experimental animals induced corneal opacities reaching a maximum at the seventh day, sometimes with ulceration. Further, the prolonged use of corticosteroid ophthalmological ointment can lead to mycotic keratitis, mycosis induced by the very fungi mentioned[7]. Little is known about the metabolites that allow saprophytic organisms* to invade corneal tissue but trauma seems necessary. The continued growth of various fungi is thought to be dependent on products elaborated during that growth[7]. In this context it is of interest to mention that strains of the above species (and others) have been used in high-yield, one-step, commercial bio-synthesis of a wide range of active steroids (including hydrocortisone) from other steriods, steroid metabolites, precursors and conjugates[26]. It has also been shown[27] that certain intestinal bacteria, i.e., *Bacterioides spp.* can deconjugate bile salts effectively. It must be remembered however, that the topical application of gall in the case of Tobit occurred once only. Further, it is likely that after four years the first fungal infection had run its course and that Tobit had acquired some immunity, *cf.* Henrici's[28] fungal toxin immunization experiments with rabbits.

Although we can rejoice with the Tobit family in that this was one fish which did not get away, it is to be doubted that the Apocrypha will be consulted as the ultimate authority on chemistry and biology. Certainly, the reader is aware that the experiment of Tobias will be difficult to reproduce, particularly because gigantic, carnivorous fish are at a premium in the Tigris today and authorities may view with jaundiced eye attempts by the laity to practice medicine with assorted gall bladders. However, should the reader still be tempted, please remember to display the sign on your lab. door—"gone fishing".

Authors Note:

* Ophthalmologists in the United States, notably Dr. L. A. Wilson, Medical College of Georgia, have expressed alarm at the rising incidence of saprophytic corneal damage attending modern practice with heavy eye make-up, the offending organism being *Pseudomonas aeruginosa.*

Acknowledgement: I wish to thank Mr H. C. Rile Jr. of the Polymer Division, Jet Propulsion Laboratory, Pasadena, California, for commissioning the drawing of Tobias and permitting its use for this publication. I am also grateful to Dr. Randal Elliot, of Wellington, for helpful discussions concerning some medical details.

Recommended Readings: Refs. 2, 7, 9, 18, 26 and "Green Medicine" M. B. Kreig, Rand McNally & Co., Chicago (1964).

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CONFERENCE 1973

CHRISTCHURCH, UNIVERSITY OF CANTERBURY

AUGUST 20-24

Chairman, Professor J. Vaughan. Secretary, Dr. D. A. House.

METRICATION FOR CHEMISTS

Compiled by J. G. Fletcher Auckland Branch Editor,
Metric Coordinator Auckland Technical Institute.

Background

The imperial system of weights and measures which evolved over the centuries in Britain is an inheritance that is currently being replaced in Britain and her former colonies by the metric system of weights and measures.

Since 1955 there has been a world-wide change towards the exclusive use of the metric system and 131 countries are now either metric or going metric. Countries at present in the process of change include the United Kingdom, Australia, South Africa, Canada and Singapore.

New Zealand's decision to change to the metric system is based almost entirely on the necessity to keep in step with her overseas trading partners; and it is for this reason metric conversion in New Zealand is planned to be substantially completed by the end of 1976.

The SI system

The modern version of the metric system known as the "International System" (also called SI—"Systeme International d'Unites") has been adopted for use in New Zealand. This system is also being adopted by all those other countries that have recently changed, or are in the process of changing, to the metric system.

There are seven basic units in the Intrnational System (SI) and it is from these units that the complete system, including the supplementary SI units, the derived SI units, and the decimal multiples and submultiples of SI units formed by prefixes, is evolved.

The seven base SI units are shown in Table I and those for everyday use, in Table 2

TABLE 1

Physical Quantity	Unit	Symbol
length	metre	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature	kelvin	K
luminous intensity	candela	cd
amount of substance	mole	mol

Correct SI

As leaders in the technical or scientific area of our employment chemists should be taking an active part in making sure that their enterprise is (a) going metric according to their industry's recommended timetable (available from the nearest Technical Institute) and (b) using the SI system *correctly.*

Surprisingly, of the products now being marketed in New Zealand in metric quantities, those which emanate from manufacturing chemists are the biggest offenders in abusing the SI system. Table 3 shows how many ways the word 'grams' has been abbreviated on packs now found on New Zealand retail shelves.

Summary of *how to write metric quantities.*

The SI system has certain simple rules. These rules (which follow with examples of their use) all apply whether the material is hand written, typed, or printed. Note: Units have *symbols* not abbreviations. Symbols do not obey the rules for abbreviations.

RULE I. USE CAPITALS CORRECTLY

(a) When written in full the names of all units start with a small letter, except at the beginning of a sentence, when a capital is used in the ordinary way.

Examples

correct	incorrect	correct	incorrect
metre	Metre	m	M
millilitre	Millilitre	ml	ML

(b) Learn which symbols are in capitals.

unit	symbol	prefix	symbol
ampere	A	tera	T
volt	V	giga	G
newton	N	mega	M
joule	J		
pascal	Pa		

RULE 2 PLURALS

(a) When written in full, names of units are made plural when necessary. Decimal fractions are always singular.

(b) Symbols for units are NEVER made plural.

Examples

130 kilometres	130 km
1.5 milligrams	1.5 mg
0.5 gram	0.5 g

RULE 3 FULL STOPS

A full stop is NOT used after a unit's symbol, except at the end of a sentence.

RULE 4 THE DECIMAL POINT

(a) The decimal point may be placed on the line or in the mid-line position.

(b) When writing numbers less than one, a zero *must* be written before the decimal point.

RULE 5 GROUPING OF NUMBERS

(a) For separating groups of three figures, the comma should no longer be used. Instead, a space is left.

(b) Where only four figures are involved, the use of the space marker is optional.

(c) Groups of three figures on either side of the decimal point should be separated by the space, where necessary.

Examples

4 768 900 litres 36 500 g 3218 or 3 218 g
(but \$4,768,900) 0.745 36 g.

TABLE 2

Quantity	Unit	Symbol	Relationships
temperature	degree Celsius	°C	
length	millimetre	mm	
	centimetre	cm	1 cm = 10 mm
	metre	m	1 m = 100 cm
	kilometre	km	1 km = 1000 m
area	square centimetre	cm^2	
	square metre	m^2	1 m^2 = 10 000 cm^2
	decare	daa	1 daa = 1000 m^2
	hectare	ha	1 ha = 10 daa
volume	cubic centimetre	cm^3	
	cubic metre	m^3	1 m^3 = 1000 000 cm^3
capacity	millilitre	ml	
	litre	l	1 l = 1000 ml
weight or mass	gram	g	
	kilogram	kg	1 kg = 1000 g
	tonne	t	1 t = 1000 kg
speed on land	kilometre per hour	km/h	
pressure in tyres	kilopascal	kPa	

RULE 6 SPACING

(a) When writing symbols for units with prefixes (e.g. kilogram or millilitre) no space is left between letters making up the symbol.

(b) When writing a symbol after a number to which it refers, a space is left between the number of the symbol.

Examples

477 ml 477 l 477 kHz

TABLE 3

incorrect symbols used for 'grams'

gr	GRMS	G.
gr.	grms	g.
GR	Gms	GR.
GMS	Gms.	gms

I.C.I. PRIZE 1972
CURRENT AND RECENT RESEARCH

L. F. Phillips

PROFESSOR PHILLIPS

The ICI Prize 1972 was awarded to Professor Leon Phillips, M.Sc., Ph.D., F.N.Z.I.C. The following is a short account of the work which gained him the award.

The work is in three main areas, namely:

(i) Studies of photosensitized processes initiated by absorption of radiation from a rapidly modulated source.

(ii) Studies of gas-phase processes initiated by absorption of He 58.4 radiation.

(iii) Kinetic measurements of reactions of atoms and small molecules in discharge-flow systems.

Other fields in which work has been published include the matrix isolation spectroscopy of Hg_2 in solids at 20K,[1] reactions of trace additives in 'dry' carbon monoxide flames,[2] and Hartree-Fock molecular orbital calculations for small molecules.[3]

The modulation studies[4] have mainly related to the formation and dissociation of gaseous charge-transfer complexes between metastable excited atoms (especially $Hg(^3P_0)$) and the electron donors NH_3, H_2O, primary amines, alcohols, and xenon. Rate constants for $Hg(^3P_0)$ reactions, quantum yields of luminescence, and radiative lifetimes of the excited complexes have been determined by measuring intensities and phase shifts of the modulated luminescence. The most recent work has involved xenon atoms excited at 147 nm,[5] and cadmium atoms excited at 320.1 nm.[6]

With the He 58.4 nm photolysis studies the most interesting feature is that the primary process yields mainly ions rather than neutral fragments.[7] Product yields have been determined for the gas-phase photolysis of CO_2, NH_3, and H_2O.[8] Rates of reaction with added gases have been measured for the excited ions N_2^{+*}, N_2O^{+*}, and CO_2^{+*} (B and A states), produced in the primary process.[9] All of these reactions are extremely fast ($k \sim 10^{-9}$ $cm^3 molecule^{-1} s^{-1}$).

The reactions in discharge-flow systems have been studied mass spectrometrically. Rates, detailed mechanisms, and product yields have been determined for the reactions of ONCl with H, N and O atoms, and of C_2N_2 with H atoms,[10] and for the reaction of H with ICN.[11] This is part of a continuing long-term programme of studying the fast reactions of small, energy-rich molecules.

To summarize, the general field of interest is the kinetics, spectroscopy, and mass spectrometry of small molecules in the gas phase, with particular emphasis on electronically excited species and other short-lived intermediates. As will be apparent from the list of references, a great deal of credit is due to the staff and students who have collaborated on the various research projects.

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Letter to the Editor

After discussions with several members of the N.Z.I.C. at the last conference and since we have decided to investigate interest in the formation of a Gas Chromatography Discussion Group.

It is hoped that such a group would become affiliated to the N.Z.I.C. in much the same way as present groups and that membership should remain open to non-members of the Institute as well as members. Affiliation to the Gas Chromatography Discussion Group of the Institute of Petroleum in Britain will be investigated.

We also intend to approach firms dealing with gas chromatographic and related equipment and materials for support to publish a newsletter which will possibly contain reviews of important papers and books, notes about the latest products and methods, and perhaps a section where a panel can answer questions. Some firms have already indicated their willingness to support such a newsletter.

We would appreciate it if anyone interested could drop a line to:

Dr. P. G. Robinson,
Department of Paediatrics,
School of Medicine,
University of Auckland,
Private Bag,
Auckland,

indicating their support, or otherwise, and offering any suggestions.

Yours sincerely,

P. G. Robinson,
J. A. Zabkiewicz,
D. G. Ferry.

IUPAC INFORMATION

ORGANIC CHEMISTRY DIVISION, IUPAC

The origins of the Organic Chemistry Division of IUPAC date from the founding of the Union in 1919. At present the activities are coordinated through a Division Committee, which for 1971-73 is as follows:

President: Prof. G. Ourisson, France

Past-President: Prof. D. H. R. Barton, U.K.

Vice-President: Prof. A. Kjaer, Denmark

Secretary: Prof. H. Zollinger, Technisch-Chemisches Laboratorium der Eidgenössischen Technische Hochschule, Universitätstrasse 6, CH-8006 Zürich, Switzerland.

Members:

Prof. V. Herout, Czechoslovakia
Prof. M. Nakajima, Japan
Prof. Yu. A. Ovchinnikov, USSR
Prof. J. Romo, Mexico
Prof. G. Wilke, Germany.

The scientific work is carried out through Commissions on Nomenclature of Organic Chemistry, Chemical Taxonomy, and Organic Photochemistry, and a Section on Medicinal Chemistry.

In addition to coordinating the work carried out by these bodies on topics requiring international regulation, standardization or codification, the Division is closely concerned with sponsorship of many major international symposia, particularly where these involve new fields of interest.

At the XXVIth IUPAC Conference (1971) the following proposals were submitted by the Division Committee to Council. It was agreed to circulate them to the National Adhering Organizations of the Union for comment at national level.

(i) The Organic Chemistry Division regrets to see an unnecessary proliferation of journals devoted to publication of the organic chemical literature.

(ii) The Organic Chemistry Division recommends that titles and summaries should be written in such a way as to facilitate information retrieval by including all the important key words.

(iii) The Organic Chemistry Division proposes for consideration by the appropriate authorities that when a preliminary communication is submitted, it should be accompanied by a fully detailed experimental section which would be available to the referees, but which would not be published. In addition, a copy of this experimental section would be available on payment of an appropriate sum to the publishing journal or to the author.

Commission on Nomenclature of Organic Chemistry

Chairman: Prof. N. Lozac'h, France

Secretary: Mr S. P. Klesney
Central Report Index,
566 Building,
Dow Chemical Co.,
Midland, Michigan 48640, USA.

The Commission was established in 1921 and a complete bibliography of its publications to date is given in *IUPAC Information Bulletin* No. 44*. The task of this body, which meets annually, is to review continually the nomenclature of organic chemistry and to prepare definitive rules for IUPAC. A revised edition of the major reference work "Nomenclature of Organic Chemistry"** has recently been published.

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* Obtainable from the IUPAC Secretariat, Bank Court Chambers, 2-3 Pound Way, Cowley Centre, Oxford OX4 3YF, UK.

**Obtainable from Butterworths, 88 Kingsway, London WC2B 6AB, UK.

In the field of nomenclature links must be maintained with related disciplines and satisfactory liaison has been developed with the IUPAC Commissions on Nomenclature of Inorganic Chemistry and on Macromolecular Nomenclature and with the IUPAC-IUB Commission on Biochemical Nomenclature. In the former instance the cooperation will shortly lead to publication of the tentative version of "Rules on Organometallic and Coordination Compounds".

Collaboration with the IUPAC-IUB Commission on Biochemical Nomenclature has resulted in publication of several joint recommendations such as on steroids. Amongst the projects presently under consideration are carotenoids, cyclitols, and carbohydrates.

Because of the complexity of present nomenclature in the field of organic chemistry, the Commission has commenced a general review of the present system.

Commission on Chemical Taxonomy

Chairman: Prof. A. Kjaer, Denmark

Secretary: Prof. T. Mabry,
Repartment of Botany,
University of Texas at Austin,
Austin, Texas 78712, USA.

This Commission, which was established in 1965, has recently held a successful symposium in Strasbourg on "Chemistry in Evolution and Systematics". In view of the interdisciplinary nature of the field, discussions are proceeding which might eventually lead to incorporation of the work of this commission into a new international organization.

Commission on Organic Photochemistry

Chairman: Prof. O. L. Chapman, USA

Secretary: Prof. K. Schaffner,
Département de Chimie organique,
Université de Genève,
30 quai de l'École-de-Médecine,
CH-1211 Genève 4, Switzerland.

Established at the XXVth IUPAC Conference in Cortina d'Ampezzo (1969) the work of the Commission is still in its early stages. Its main tasks are to promote international agreement on nomenclature, specification of standards such as criteria for identification of excited states, measurement of quantum yields, and standardization of filters.

Section on Medicinal Chemistry

Chairman: Prof. E. Campaigne, USA.

Secretary: Dr A. I. Rachline,
Chemical Research Department,
Hoffman-La Roche Inc.,
Nutley, New Jersey 07110, USA.

This Section was formed in 1969 when its terms of reference were:

1. To promote the international exchange of information in the field by joint meetings with member countries to unify international medicinal chemical work;
2. To promote cooperation between medicinal chemists and related disciplines in all member countries to base firmly the major medicinal areas on standard comparison and drug analysis;
3. To cooperate with other international organizations which deal with the various aspects of medicinal chemistry;
4. To advance research in the field of medicinal chemistry by promoting international congresses, publications, and personal relations among scientists within the discipline.

Close links have already been established with medicinal chemistry organizations in most of the countries adhering to IUPAC and also with WHO and FAO. In order to extend this cooperation the Section produces a regular newsletter and the Secretary is pleased to add further names to the distribution list.

The first report to emanate from the Section concerns "Bad Patent Practices". Re-

cently published in *Information Bulletin* No. 41, it concluded that the abstracting services were aware of the existence in patent literature of compounds which seemed unlikely ever to have been prepared, much less characterized in accordance with proper chemical discipline. It was clear, however, that as a last resort a would-be inventor must use his own scientific judgement to decide whether a claim was valid or needed checking experimentally.

A report on "Education in Medicinal Chemistry" is expected to be published in the future.

IUPAC INFORMATION BULLETIN

No. 44 December, 1972

Summaries of the activities of the six Divisions of IUPAC (Physical, Inorganic, Organic, Macromolecular, Analytical, and Applied) and the Clinical Chemistry Section during the period August 1971-September 1972, constitute a major feature of the present issue of the *Information Bulletin*. Presidents of all the Divisions present annually to the IUPAC Bureau status reports of the projects currently in progress in their respective Divisions, those completed during the preceding year including any publications arising therefrom, and any new projects contemplated. This year the meetings of the Bureau and Division Presidents were held in Strasbourg in September 1972.

It has been decided that the XXXVIIth IUPAC Conference will be held in Munich during 21-31 August 1973. At the Conference (for National Delegates and Members of IUPAC bodies) over 100 meetings of various IUPAC Divisions/Sections/Commissions are scheduled; the deliberations will be published eventually in *Comptes Rendus XXVII Conference*. Up-to-date information regarding the XXIVth IUPAC Congress to be held in Hamburg during 3-8 September 1973 is included in the present issue of the Bulletin. The Conference is being organised under 7 sections: high polymers; chemistry of organic natural products; solid-state chemistry; compounds of nonmetals; applied electrochemistry; radiochemistry; and information and communication in chemistry. In addition two joint symposia are planned: polypeptide hormones and releasing factors; and modern methods for treatment of waste water in theory and practice. Details of the Symposium on Contribution of Chemistry to Food Supplies planned at Hamburg just before the Congress (29-31 August 1973) under the joint auspices of IUPAC and IUFoST are also included.

Reports from specific IUPAC Committees included in this issue are from: Section on Fermentation Industries, Section on Water Quality, Commission on Analytical Reactions and Reagents, Commission on Physicochemical Measurements and Standards, Section on Organic Coatings, Commission on Automation in Clinical Chemistry, Commission on Quantities and Units in Clinical Chemistry, Section on Clinical Chemistry, Commission on Equilibrium Data, Commission on Colloid and Surface Chemistry, Committee on Publications, Section on Food, Coordinating Committee for Analytical Methods for CEE and IARC, and Section on Medicinal Chemistry.

The Charter of the Book adopted by the international professional organisations of authors, publishers, librarians, booksellers, and documentalists in association with UNESCO has been accepted by IUPAC and is reproduced in this issue.

Brief accounts of 18 IUPAC-sponsored Symposia held in 1972 are included together with detailed information on 10 forthcoming IUPAC-sponsored Symposia.

Other features are listings of final (definitive) reports published in *Pure and Applied Chemistry* during 1972 and of the latest tentative nomenclature reports and technical reports published as appendices to the Bulletin.

SI UNITS

Recommendation for Use of SI in Clinical Laboratory Measurements

Representatives of ICSH, IFCC, and WAPS* met in combined session in Munich on 14th September 1972, on the occasion of the VIIIth World Congress of Anatomic and Clinical Pathology. They agreed to recommend to the medical practitioners and all others concerned with health services throughout the world the following principles with regard to units of measurement for medical laboratory results.

1. The *International System of Units* (SI) is accepted in its broad application.
2. In accordance with chemical usage the preferred unit of volume is *litre*, symbolized "l".
3. For multiples and submultiples of units, including derived units, only one prefix should be used. For preference this should be confined to the numerator; exception is made in the case of the kilogram. Thus, units of concentration should use the litre as the denominator.+
4. For quantities concerning a component with sufficiently well-known chemical structure, "molecular kinds of quantities" based on *amount of substance* (using the unit *mole*) are recommended.+)
5. In principle, a report of a determined quantity should always include information on 1. system, 2. component, 3. kind of quantity, 4. numerical value, and 5. unit. Thus, as an example, "plasma iron" can be reported as "Plasma−Iron (II+III), substance concentration = 23μmol/l" (abbreviated: P−Iron (II+III), substc. = 23μmol/l).++
6. The three organizations named above agree to consult in the future before advising on implementation of recommendations on quantities and units. For this purpose a Liaison Committee on Quantities and Units will be established, consisting of one representative of each of the three bodies.
7. Further information regarding specific recommendations can be obtained from the representative of the appropriate organization, as follows.
   ICSH: Dr S. M. Lewis, Royal Postgraduate Medical School, Hammersmith Hospital, London W 12, UK.
   IFCC: Dr R. Dybker, Department of Clinical Chemistry, Geriatric Unit, De Gamles By, Nørre Allé 41, DK-2200 Copenhagen N, Denmark.
   WAPS: Dr J. R. Schenken, Nebraska Methodist Hospital, 3612 Cuming Street, Omaha, Nebraska 68131, USA.

For ICSH: O. W. van Assendelft, R. J. Eilers, A. von Klein-Wisenberg, S. M. Lewis, J. Spaander.

For IFCC: J. Büttner, R. Dybkaer, A. H. Holtz

For WAPS: G. Astaldi, K. G. von Boroiczény, B. E. Copeland, G. J. Corley, P. I. A. Hendry, C. E. D. Taylor, F. D. White.

References

1. SI The International System of Units.
   National Physical Laboratory.
   Her Majesty's Stationery Office, London, 1970.
2. Recommendation 1966.
   In: Quantities and Units in Clinical Chemistry.
   R. Dybker and K. Jørgensen.
   Munksgaard, Copenhagen, or The Williams and Wilkins Company, Baltimore, 1967.
3. Quantities and Units in Clinical Chemistry, and
   List of Quantities in Clinical Chemistry.
   International Union of Pure and Applied Chemistry and International Federation of Clinical Chemistry.
   Information Bulletin Nos. 20 and 21. IUPAC, Oxford, 1972.

+ Because of uncertainty concerning the elementary entity of hemoglobin to be used in calculation, ICSH recommends that for the time being hemoglobin concentration in blood should be expressed as mass concentration, either in g/l or in g/dl. It is, however, permitted to use substance concentration (e.g. in mmol/l); in this case the elementary entity (monomer or tetramer) should be specified.

++ Rules of detail cannot be given for universal use. The principles should be applied according to language and circumstances.

International Committee for Standardization in Hematology (ICSH) International Federation of Clinical Chemistry (IFCC) World Association of (Anatomic and Clinical) Pathology Societies (WAPS).

INSTITUTE OFFICERS 1972-73

PROFESSOR R. CORBETT

PRESIDENT:

Professor R. E. Corbett ,F.R.S.N.Z., F.N.Z.I.C., the Institute's new President is Mellor Professor and Chairman of the Department of Chemistry at Otago University where he was first appointed to an Assistant Lecturship after graduating from Otago University in 1944. He was promoted to the Second Chair of Chemistry in 1966 and succeeded to the Mellor Professorship after the retirement of Professor H. N. Parton at the beginning of 1972. As the holder of a Shirtcliffe Research Scholarship and a National Research Scholarship, he spent 1948-49 engaged in research for the Ph.D. degree with Professor Alexander Todd, F.R.S. (now Lord Todd) at Cambridge University. A Carnegie Travel Grant enabled him to visit the United States in 1950, and he spent 1958 in the United Kingdom at the invitation of the Nuffield Foundation.

Professor Corbett's research interests are New Zealand Natural Products, principally the terpenoid compounds that can be isolated from essential oils and from bark, heartwood and lichen extractives. In 1956 he was awarded the Easterfield Medal of the Royal Institute of Chemistry for his work in this field.

Professor Corbett has combined an active career in research, teaching and administration. He has been secretary of the Nuffield New Zealand Advisory Committee since 1951, a member of numerous University Committees and Dean of the Science Faculty, and during the past ten years has been heavily involved in the Chemistry Department building programme.

FIRST VICEPRESIDENT: Dr P. K. Foster (Wellington).

SECOND VICEPRESIDENT: Dr C. L. Davey (Waikato).

BRANCH OFFICERS

Auckland

The Auckland Branch Committee for 1973-74 is:

Chairman, Mr. R. H. Hopgood; Immediate Past Chairman, Dr. G. A. Wright; Committee, Mr. A. C. Kennett, P. Nelson, I. Clements; Hon. Secretary, P. Robinson; Hon. Treasurer, Dr. I. Devereux; Branch Editor, Mr. J. G. Fletcher; Hon. Auditor, Mr. L. S. Spackman.

R. H. HOPGOOD

R. H. Hopgood was born in Oamaru in 1925 and educated at Papanui High School and Canterbury University (B.Sc.). He joined Fletcher Industries in Christchurch as a chemist in 1944, and has been closely connected with the company's wood product development and other manufacturing. He has held many executive positions in both New Zealand and Australia. He was appointed Managing Director of Fletcher Industries in 1965, and also a Director of Fletcher Merchants. He is now Fletcher Holdings Associate Director (Research and Development).

Canterbury

Chairman: Dr W. S. Simpson, Secretary: Dr J. W. Blunt, Treasurer: Dr. C. G. Freeman, Committee: C. L. Hintz, Dr P. Meredith, P. R. Richards, J. R. Sharman, Editor: Dr I. L. Weatherall, Delegate: Dr A. G. Williamson.

W. S. SIMPSON

Dr W. S. Simpson is a Principal Scientist and Head of the Wool Science Section of the Wool Research Organisation of New Zealand. He graduated M.Sc. with honours in chemistry from Canterbury University College in 1956. He then went to Leeds University as Defence Science Corps Scholar graduating Ph.D. in Textile Physics in 1960. Until 1962 he was Equipment Development Officer for the New Zealand Armed Services, holding the rank of Captain. He joined the staff of the Wool Research Organisation in 1962 and was based at the Gracefield Laboratories of DSIR Chemistry Division before transferring to the new laboratories at Lincoln in 1967. Dr Simpson heads a team of eight scientists engaged on research into the development of new products and processes for wool utilisation.

Manawatu

Chairman: Mr G. M. Ryburn, Secretary: Dr M. J. Hardman, Treasurer: Mr C. Tow-Towler, Committee: Mr M. J. Boland, Dr. A. M. Brodies (Branch Editor), Dr R. P. Garland, Dr D. F. Newstead, Dr P. G. Roughan, Dr I. D. Watson.

G. M. RYBURN

Graham Ryburn is General Production Manager at Unilever's ice cream factories in Palmerston North and Papatoetoe. Born in Dunedin and educated at John McGlashan College, he graduated B.Sc. from Otago University in 1956.

On leaving University he spent four years with Tasman Vaccine Laboratory before joining Lever Brothers at Petone in 1961. Appointed Production Manager in 1963 he later travelled to U.K. and joined Van der Berghs and Jurgens Ltd. at Purfleet near London. There he spent a year in a development team working on the processes for hardening, interesterifying and fractionating edible fats and oils used in margarine and cooking fat. While in London Mr Ryburn underwent training with Unilever's Packaging Advisory Department before returning to New Zealand in 1965.

After two years with Birdseye in Hastings, he moved to Palmerston North where he was appointed General Production Manager (ice cream) in 1970. During 1972 he attended a Unilever international management course in London and visited ice cream businesses in U.K., Europe, South Africa, and Australia.

Mr Ryburn has been an Associate Member of the Institute since he joined the Wellington Branch in 1960, and a member of the Manawatu Branch for the past seven years.

Wellington

Chairman: Dr L. J. Porter, Treasurer: Dr C. W. Childs, Committee: Mrs Z. Demchenko, G. Clark, F. Hurst, A. Turner, Branch Editor: Prof. R. Ferrier, Council Delegate: L. Stonyer.

L. J. PORTER

Dr. L. J. Porter graduated M.Sc with second class honours in Chemistry from Victoria University in 1964. Continuing in the Chemistry Department as a Junior Lecturer, he studied the metal-ion catalysed hydrolysis of α-amino acid esters under the supervision of Dr. R. W. Hay, graduating with a Ph.D. on this topic in 1967.

He joined Chemistry Division, D.S.I.R. in the same year subsequently being associated with Dr. K. R. Markham on research into methods of flavonoid analysis and the flavonoid chemistry of lower plants, and with Dr. D. F. S. Natusch on n.m.r. studies of the interaction between metal-ions and sulphur-containing amino acids. He was a Research Fellow at the Flinders University of South Australia in 1970 working with Professor J. W. Clark-Lewis on the Chemotaxonomy of *Acacia* species. After returning to Chemistry Division his current research interests include the chemistry of condensed tannins, chemotaxonomy and bark utilization.

He was N.Z.I.C. Conference Secretary in 1972.

Dr. Porter is married with 2 children. His major passion is golf.

C. L. DAVEY

Waikato

Chairman: Dr C. L. Davey. Secretary: Dr I. H. C. Gallagher. Treasurer: Dr J. H. Watkinson. Committee: Dr A. G. Langdon, Dr M. M. Sutton, Dr L. Main, Dr D. E. G. Sheat. Council Delegate: Dr J. H. Watkinson.

Dr C. L. Davey graduated M.Sc. with first class honours in chemistry from Otago University in 1953. From there he went to Cambridge University to study in the field of the biochemistry of muscle action, graduating Ph.D. in 1957. Returning to New Zealand, he joined the staff of the Meat Industry Research Institute. In 1963 he spent a period at the Institute for Muscle Diseases, New York, continuing studies into muscle biochemistry, an area that is still his major research interest. With the realisation of the link between muscular contraction and meat toughness, these basic studies take on a crucial relevance to the New Zealand meat industry. It is during the processing of our meat from slaughter to freezing that major damage can be done to tenderness. In the approach to prescribing processing conditions to avoid muscle shortening and toughness, Dr Davey has participated in basic biochemical studies into rigor mortis, cold stimulation of muscle and the structural basis of muscular contraction.

Dr Davey is Deputy Director of the Meat Industry Research Institute. He is Science Representative on the Board of Governors at Waikato Technical Institute.

Otago

Chairman: Assoc. Prof. D. J. Brasch, Hon. Secretary: M. R. Anderson, Hon. Treasurer: Dr G. W. Emerson, Committee: Prof. R. E. Corbett, J. L. Grigg, Dr R. Laverty, J. W. McChesney, A, N. Scrygeour, Delegate: Prof. G. B. Peterson, Branch Editor: Prof. D. J. Brasch, Hon. Auditor: T. A. Thomson.

D. J. Brasch completed his M.Sc. (Hons) at Victoria University College in 1952, and worked in the Dominion Laboratory until 1954 when he was awarded a Fulbright Scholarship to study wood chemistry at the Institute of Paper Chemistry, U.S.A. for two

years. He then wen to Queen's University, Canada, completed a Ph.D. degree in 1958 under Professor J. K. N. Jones, F.R.S., and returned to Chemistry Division, D.S.I.R. While working there in the Chemical Engincering Section, he showed the technical feasibility of producing rayon grade pulp from New Zealand grown *Pinus radiata.*

In 1967, Dr Brasch joined the University of Otago where he is now Associate Professor of Applied Chemistry. Under his direction Applied Chemistry Courses have develloped to form an important part of the chemistry degree structure.

Dr Brasch is the author of a series of papers on the chemistry of *Pinus radiata,* and several papers on the pulping of the species. He is a member of the Chemical Engineering Group of the New Zealand Institution of Engineers, and for the past four years has been a guest lecturer at the School of Forestry, University of Canterbury, where he lectures on wood chemistry and pulping reactions.

D. J. BRASCH

OBITUARIES

SIR THEODORE RIGG
K.B.E., M.A.(Cantab.), M.Sc., Hon.D.Sc. (W. Australia & N.Z.), F.R.S.N.Z., F.R.I.C., Hon. F.N.Z.I.C.
1888-1972

Theodore Rigg will be remembered and honoured for his pioneering studies of soil and for his help in laying the administrative foundations of scientific research in New Zealand.

Born in Yorkshire in 1888 he came with his parents in 1894 to Wellington where he was educated at Wellington College (with distinction) and at Victoria University College (1907-1912) gaining his M.Sc. under Professor T. H. Easterfield. Awarded the Jacob Josephs Scholarship for chemical research and the 1851 Exhibition Science Scholarship in 1912, he proceeded to Cambridge to study agricultural research taking his B.A. in 1912 and M.A. in 1924.

During World War I Theodore Rigg served with members of the Society of Friends in the risky and hungry work of re-establishing agriculture in stricken areas of S.E. Europe. This was followed in 1919 by soil

research at Rothamsted Experimental Station and at the Soil Survey Division of the U.S. Department of Agriculture. Joining the Cawthron Institute staff in 1920 as Agricultural Chemist he became Assistant Director in 1928, succeeded Sir Thomas Easterfield as Director in 1933 and retired in 1956.

Under his leadership the soil section of the Cawthron Institute carried out important investigations of practical and fundamental value. Initial results from the chemical analyses and field trials led to the establishment of extensive soil surveys in the province, the the causes of low productivity in soils of the Moutere Gravels and pakihi lands being closely studied. Results led to recommendations to farmers of corrective fertiliser treatments which produced notable improvements in yield and quality of their crops—chiefly export fruits, tomatoes, hops—as well as in pastures and animal products. Theodore Rigg also directed soil surveys in the North and South Islands which were the foundation of the Soil Bureau D.S.I.R., and he established the Hop and Tobacco Research Stations near Motueka.

The Cawthron Institute's extensive investigations into the functions of minor ("trace") elements in plant and animal nutrition are famous.

This account of Theodore Rigg's career has been kept mainly within the scope of chemistry for in chemistry he was trained and as a chemist he remained at heart during his long and dedicated working life. But he was also a noted agriculturalist and science administrator, and these important aspects of his work are best left for recording elsewhere. Suffice it to say that he was an original member of the N.Z. Research Council serving for 28 years; from 1943-1954 he was Chairman. He was President of A.N.Z.A.A.S. 1954. He was knighted (KBE) in 1938.

Members of the N.Z. Institute of Chemistry tender their sympathy to Lady Rigg (formerly Dr Catherine Curtis, Mycologist to the Cawthron Institute); and to the two daughters of his first marriage, Ester Mary (Mrs Hugh Penhale) and Helen (Mrs David Hughes).

At his funeral service in the Nelson Cathedral many friends and colleagues gathered to pay respect to the memory of Theodore Rigg, the eminent scientist—so kindly, generous and humane.

C. BARNICOAT.

F. MORGAN M.P.S., A.N.Z.I.C.

Francis Morgan died in early December 1972. He was a leading figure in the New Zealand food and drug industry. He founded the Wellington Drug Company Ltd. and served on the Council of the Wellington Manufacturers' Association for more than twenty years. He was the honorary treasurer of the Wellington Red Cross for many years and served on boards of various educational institutions.

BRANCH NOTES

Auckland

Annual General Meeting November 1972

The Chairman, Dr. G. A. Wright, presented a lengthy, detailed, Annual Report by the committee (copies of the Annual Report are available from the secretary) which reviewed a very active year's work. Especially noted was the hard work the retiring secretary Mr. Gary McSweeney did during his two year period in office. Gratitude was also expressed to Mr. John Hawthorne (Council delegate) and Mr. George Corban for their service to the Branch.

The A.G.M., after considerable discussion, resolved to support a new grade of membership lower than the present Associateship but conferring some professional status. Such a grade is often called a licienteship' grade of membership.

The local subscription was raised by $1 to cover increasing local costs. The subscriptions for Auckland Branch members are now $10 for Fellows and Associates, $4 for Graduate members and $3.50 for local members.

Personal

Mr. G. Ruffel has joined Aerosol Products Ltd. as Chief Chemist.

Mr. P. Barron is now chief chemist of Fletcher's Plycoparticle Board factory in Christchurch.

Mr. Ray Hopgood (Fletcher Industries) has been appointed to the Testing Laboratory Registration Council.

Dr. I. Devereux of Rocklabs Ltd., Auckland Branch Treasurer, has received an Anzac scholarship. He will study at the Department of Applied Mineralogy, C.S.I.R.O. Perth, Australia, for seven months from April 1973.

University of Auckland

Mr. T. A. Turney gave an address to the Student Chemical Society on "The Chemist and the Poet". He has recently published a volume of his collected poems.

Dr. G. A. Bowmaker has been awarded a research grant by the University Grants Committee to purchase a Varian E4 Electron Spin Resonance Spectrometer.

Dr. J. Aggett has been promoted to Associate Professor and Drs. Bowmaker and G. E. F. Rickard become Senior Lecturers.

Auckland Technical Institute

A full-time course to enable technicians to qualify for the New Zealand Intermediate Certificate in Science and the Auckland Technical Institute's Full Time Technician's Certificate will be offered for the first time in 1973.

Wellington

G. H. Edwards (Director of Standards Institute) has been appointed by the Minister for Science to the Testing Laboratory Registration Council.

V.U.W. Chemistry Department

Professor J. W. Tomlinson left on 21st December for nine months sabbatical leave which will be spent mainly at Imperial College, London.

Drs D. D. Macdonald and P. J. Pearce have been appointed to Lectureships in Physical Chemistry, and arrive early in 1973. Dr Macdonald is an Auckland graduate who has studied for several years in Canada; Dr Pearce, after secondary education in Christchurch, graduated from Melbourne and has post doctoral experience in the United States. Both have particular interests in the study of pressure effects on chemical systems

Dr A. G. Freeman has returned from the Antarctic where, as a member of the V.U.W. Antarctic Research Team, he has been studying the natural crystallisation of salts in that region.

Dr G. S. Bethell leaves in February to undertake post doctoral studies with Professor S. J. Angyal in Sydney.

S. R. McConnell has been awarded the McKee Trust Postgraduate Scholarship.

V.U.W. Biochemistry Department

Dr. T. W. Jordan, a Ph.D. graduate of the Department, has completed three years post doctoral works in England, and returned as a Lecturer in November.

D.S.I.R. Chemistry Division

Mrs A. Goldman, whose husband has been transferred with the Leather Research Institute to Palmerston North, has left the Food Section for the Dairy Research Institute, also at Palmerston North.

Mr J. G. Phillips a recent B. of Food Science (Hons.) graduate from Leeds University has joined the Food Section.

Canterbury

Mr. B. R. Scott, Government Analyst, Dunedin, has been appointed Officer-in-Charge, Chemistry Division, DSIR Christchurch, and Government Analyst for Christchurch and Dunedin.

Mr. Guy Brown, formerly of the Metropolitan Police Laboratory London, has joined the staff of Chemistry Division, DSIR Christchurch.

Dr. J. M. Coxon has returned to the Chemistry Department, University of Canterbury, after a year's sabbatical leave working with Professor Battiste, University of Florida, Gainesville.

Manawatu

The Institute of Chemistry Prizes for the best students in third year chemistry and biochemistry at Massey University have been awarded to Miss H. A. Bergen and Mr. A. R. Stowell respectively.

Mr G. M. Ryburn, the Manawatu Branch Chairman, is to represent the New Zealand Institute of Chemistry on a committee to investigate the promotion of science-based industries in the region (see December Branch News).

Massey University

Dr. L. F. Blackwell and Miss M. N. Wilson have been promoted to Senior Lecturers in the Department of Chemistry, Biochemistry and Biophysics.

Dr. H. F. Shurwell, Queens University, Ontario, visited the department and gave a stimulating lecture on the applications of Laser Raman spectroscopy for chemical and biochemical systems.

Dr R. Grant, T.V.L. Ltd., U.K., was another visitor to the Department of Chemistry, Biochemistry and Biophysics. Dr Grant who is involved in the development of protion resins spent a day in discussions with staff members.

New Zealand Dairy Research Unit

Recently appointed Research Officers include Mr. M. F. Peberdy (Microbiology), Mr. D. S. Munro (Butter and Milkfat) and Mrs. A. Goldman (New Uses for Milk Products).

Mr. D. J. Moran has been appointed as Manager of the Product Development Centre. Mr. Moran was formerly a Senior Technical Officer with the Dairy Board.

Dr. L. K. Creamer has recently returned after doing six months research work in the school of Biological Science, Bradford University, Yorkshire.

Mr. O. E. Mills has returned after working one year at the Paper Industries Research Association, Leatherhead, Surrey.

Dr. P. S. Robertson is to visit Britain, the Republic of Ireland and Canada. While overses Dr. Robertson will attend the commissioning of two Cheddarmaster installations. Several Cheddarmasters have now been sold overseas and Dr. Robertson will be investigating further marketing opportunities during his visit.

NOTICES

NEW ZEALAND GEOCHEMICAL GROUP SYMPOSIUM

NELSON, 14th-16th MAY, 1973

A N.Z. Geochemical Group Symposium will be held from 14th to 16th May 1973 at the Cawthron Institute, Nelson, New Zealand. The symposium will comprise 2-2½ days of papers and ½ a day when delegates may either go on a local field excursion or visit the Lime & Marble Ltd., and Cawthron Institute geochemical laboratories. Suggested topics for papers include:

Low temperature metamorphism and hydrothermal alteration
Geochemistry of ore deposition
Petrochemistry of mafic and ultramafic igneous rocks
Geochemical prospecting
Geochemistry and the environment
Analytical techniques

Papers on other geochemical topics will, however, be most welcome.

Tentative titles of papers should be sent to the Secretary by 1st March 1973.

ANZAAS CONGRESS 1973

The 45th A.N.Z.A.A.S. (Australia and New Zealand Association for the Advancement of Science) will be held at Perth, Western Australia, August 13-17, 1973.

REMINDER NOTICE

April 30 is the closing date for the Chemical Essay Prize (for Regulations see *Chem. in N.Z.*, (1971), *35*, No. 2. p.53) and for the I.C.I. prize.

THE NEW ZEALAND FERTILISER MANUFACTURERS' RESEARCH ASSN (INC.)

STAFF APPOINTMENTS

The New Zealand Fertiliser Manufacturers' Research Association wishes to add to its present team of nine graduate and 10 technical staff. The Association has well-equipped laboratories and a library with interloan privileges at Otara, South Auckland.

F.M.R.A. serves the six companies which in 12 works throughout New Zealand currently manufacture over 600,000 tonnes of sulphuric acid and more than 2,000,000 tonnes of fertiliser per annum. The growth of the fertiliser industry and its Research Association's increasing contribution to technical development offer good prospects for advancement.

The need is for people with good qualifications and preferably with experience in inorganic or physical chemistry, chemical engineering, or physics, who are outward looking and interested in, and have the capacity for, co-operation with staff at Otara and in the fertiliser companies as well as Government and university scientists. Research is in progress on raw materials, manufacturing processes, effluent control and recovery, and agronomic evaluation of fertilisers. There is a particular vacancy for someone with experience in X-ray diffraction and X-ray fluorescence methods.

The minimum salary offered is $4,000 for a B.Sc. without experience, with opportunities for advancement to $9,000 and higher on merit. Salaries are reviewed annually and superannuation is available.

Applications should be addressed by 31 March to:

The Director,
N.Z. Fertiliser Manufacturers' Research Assn,
P.O. Box 23-594,
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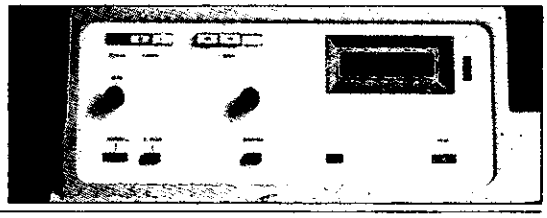

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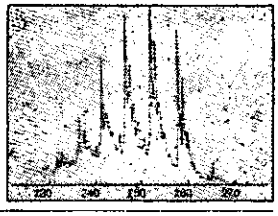

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