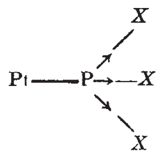
exactly opposite character—a mechanism which would be enhanced by the large inductive effect of the fluorine atoms—and is impossible in the formation of complexes by boron trifluoride.

The second suggestion seems the more probable, because, if we accept Pauling's supposition that unhybridized d-orbitals can take part in valency formation, these striking differences between the co-ordination chemistry of platinous chloride and tricovalent boron can be explained in a simple qualitative manner.

In the platinous complexes we have a σ-bond Pt-P, the classical co-ordinate link, formed by the combination of a filled $3s3p^3$-orbital of the phosphorus atom and a vacant $5d\ 6s6p^2$-orbital of the platinum atom, together with a π-bond formed by the overlap of a *filled* $5d$-orbital of the platinum atom and a *vacant* $3d$-orbital of the phosphorus atom. Thus the electrons for the σ-bond are supplied by the phosphorus atom and for the π-bond by the platinum atom; and as the electronegativity of X



increases, the drift of electrons forming the π-bond will partially neutralize the inductive effect of the atoms X. The availability of the lone-pair for σ-bond formation will thus not be impaired to the same extent as in the absence of a π-bond, so that in practice we find that the stability of the complex is not greatly affected by the electronegativity of X. In the boron series, where no d-electrons are available, we observe only the decreasing strength of the σ-bond as X increases in electronegativity from the stable tri-n-propyl phosphine complex through the weakly bound phosphorus trichloride complex, culminating in the complete disruption of the bond in such non-existent compounds as $BF_3.PF_3$.

A parallel suggestion has already been made with reference to the carbonyl compounds, where a secondary interaction is suggested between the d-orbital of the metal and the π-bonds of the carbon monoxide molecule[10]. It is not so easy to see how the two carbon atoms of the ethylene molecule can be bound by a π-bond to the platinum atom, but the mechanism of bonding has undoubtedly many similarities to that of the carbonyl[6].

Thus there is direct chemical evidence available to demonstrate that the lone-pair theory is inadequate to explain co-ordination to the heavier transition and neighbouring metals, particularly of platinum, and this evidence tends to support the conclusions of Pauling[2] and Phillips, Hunter and Sutton[1], based on physical measurements capable of less direct interpretation.

It will be interesting to see whether phosphorus trifluoride can replace carbon monoxide entirely from the volatile metal carbonyls without altering their character, and also to compare the behaviour of phosphorus trifluoride with that of nitrogen trifluoride where there are no vacant $2d$-orbitals, so that π-bonding could not enhance the stability of the platinous complex. A suitable name for such a π-bond is a 'dative π-bond', and the bond as a whole may be called a 'dative double-bond', to distinguish it from the ethylenic double-bond where the paired electrons are supplied equally by each atom.

[1] *J. Chem. Soc.*, 146 (1945).
[2] "Nature of the Chemical Bond", 250 *et seq.* (Cornell: Univ. Press, 1948).
[3] *J. Chem. Soc.*, 55 (1949).
[4] Baumgarten, P., and Bruno, W., *Ber.*, **80**, 517 (1947).
[5] Bury, A. B., and Schlesinger, H. I., *J. Amer. Chem. Soc.*, **59**, 780 (1937).
[6] Chatt, J., *J. Chem. Soc.*, 3340 (1949).
[7] Schutzenberger, P., *Bull. Soc. Chim.*, **17**, 482 (1872); **14**, 17 (1870).
[8] Chatt, J., and Hart, F. A., *Chem. and Indust.*, 146 (1949).
[9] "Complex Compounds of Platinum with Unsaturated Molecules" (Soviet Acad. Sci., 1945).
[10] Hieber, W., *Die Chemie*, **55**, 25 (1942).

GOVERNMENT RESEARCH IN AUSTRALIA

FINAL REPORT OF THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

THE twenty-second—and last—annual report of the Council for Scientific and Industrial Research, Australia*, covers the year ended June 30, 1948, since when, on May 19, 1949, the Council has been replaced by the Commonwealth Scientific and Industrial Research Organisation (see *Nature*, April 30, 1949, p. 671, and August 6, p. 223). The first annual report of the latter body, for the year ended June 30, 1949, has already been tabled in the Australian Parliament. The formation of the new Organisation was also accompanied by the retirement of Sir David Rivett after twenty years of service as chief executive officer and more recently as chairman, and also of Dr. A. E. V. Richardson, who succeeded him in the former post.

During the course of the year ending June 30, 1948, the status of the Section of Tribophysics was changed to that of a Division, and during the year a site was acquired at Geelong for a Division of Wool Textile Technology. A study was made of the wool carbonizing process; pilot plant was being constructed for the study of solvent degreasing, and investigations were extended to include biochemical studies of the protein structure of wool, electron microscopic studies of the wool fibre and the keratin molecule, and work on wool wax. The Council also assisted financially the work of the British Wool Industries Research Association at Torridon, Leeds. At the request of the Northern Australia Development Committee, the Council undertook a soil and vegetation reconnaissance survey of the most favourable parts of the northern areas. The possibility of an irrigation programme in the Kimberley–Ord River region of Western Australia was also investigated, and a regional headquarters laboratory was established at St. Lucia, in association with the University of Queensland, where facilities will be available for studies on general soils, crops and pastures.

The Council, besides giving further attention to the problems of the utilization of coal, commenced work on the microstructure of coal in collaboration with the Botany Department of the University of Melbourne, and a Coal Survey Section was established to assist in preparing a comprehensive survey of the physical and chemical properties of coals from all the main Australian coal-fields. During the year the

* Parliament of the Commonwealth of Australia. Twenty-second Annual Report of the Council for Scientific and Industrial Research for the Year ended 30th June, 1948. Pp. 141. (Canberra: Commonwealth Government Printer, 1949.) 8*s*.

Australian Leather Research Association was established, and this Association was supported by the Council with a grant equal in amount to the total money it spent on scientific research, up to a maximum of £5,000 a year.

In collaboration with the Australian National Research Council, the Council also undertook responsibility for a new scientific quarterly, the *Australian Journal of Scientific Research* (see *Nature*, **162**, 210 and 808; 1948), while special reference is made in the report to the collaboration of the universities in the Council's investigations. The staff difficulties of the Information Section were somewhat mitigated, and the main trend of the work of the Section showed a greater emphasis on the solution of technological inquiries. Ninety-six bibliographies and summaries of information were prepared during the year, and the systematic preparation and circulation of contents sheets and summaries of Russian scientific periodicals were continued, in addition to both oral and formal translation work. Films entitled "Northern Australia Reconnaissance Surveys" and "Irrigation Research N.S.W." were released during the year, and six others were in the course of production. The Library was maintained as a system rather than a library unit, the union catalogue at the head-office library providing the main connecting link. Besides lists of scientific and technical staff and of personnel of the Council and its committees, a list of publications during the year, arranged under divisions, is appended to the report.

Reviewing the work of the different divisions, the report notes that progress was made by the Division of Plant Industry in developing new disease-resistant lines of potatoes, and work continued on the establishment of various pasture species when sown with cereal crops, on the field germination of subterranean clover and its response to molybdenum, on the trial of foreign grasses and legumes, and on the fertilizer requirements of the three main soil-types. Besides work on mineral deficiency and on natural pastures, the Division investigated a number of plant diseases and their control by chemical means, as well as the effect of plant-growth regulating substances. The results of soybean trials were conflicting; but progress was made in the use of opium poppy for morphine, *Duboisia* spp. as sources of hyoscine and atropine, and more particularly in the survey of native plants for sources of pharmacological substances and the investigation on the occurrence of rutin in *Eucalyptus macrorrhyncha*. An extended programme continued on tobacco plants, tomatoes and tomato hybrids, beans resistant to bacterial blights, and the witches' broom disease of lucerne.

The Division of Economic Entomology reports that control of St. John's wort by introducing insect enemies continued to fulfil its early promise. The great value of pentachlorophenol in the preservation of timber from termite attack was demonstrated, and comprehensive investigations on the control of insect pests of cabbages showed that the most effective means of control is an all-purposes combination dust or spray containing D.D.T. and an aphicide. Two major expeditions were organised by the Division to study the distribution of injurious insects and to collect material for taxonomic study. Much difficulty is reported in animal health and production investigations; but at the Animal Health Research Laboratory, Melbourne, the experiment on the influence of nutritional stresses on immunity against pleuropneumonia of cattle was concluded, and extensive trials were carried out with penicillin in mastitis of dairy cattle. Studies on phenothiazine, an anthelmintic, were continued at the McMaster Animal Health Laboratory, and other anthelmintics were tested against *Paramphistomum* spp. in sheep. Sheep dipping, the blowfly-strike problem and the bionomics of the foot-louse of sheep also received attention, while at the McMaster Field Station investigations on the inheritance of skin wrinkles and polledness in sheep were concluded.

Five years of experimental work by the Division of Biochemistry and General Nutrition finally proved that appropriate manurial treatment with superphosphate containing zinc and copper would allow good permanent pastures to be established on tracts in South Australia deficient in copper, zinc, molybdenum, etc., and it is estimated that in this way at least three thousand square miles of practically useless terrain can be developed. The correlation between wool production and nutrition of sheep, and the processes of rumination and vitamin A requirements of sheep were also studied. The demand for examination of areas for land settlement appeared to be diminishing, and more of the time of the Division of Soils should be available for studies in pedology and for soil problems of a physical, chemical or microbiological nature. The reports of the Soil Chemistry and Soil Physics Sections, the Soil Microbiology Section and the Soil Physics and Mechanics Section record much useful work.

At the Commonwealth Research Station, Merbein, where the staff was built up to above the pre-war level, investigations were initiated on the major problems of the irrigated lands of the middle and lower Murray, the economic plants of these areas, and the processing and care of the products, while at the Irrigation Research Station at Griffith field experiments with orange trees, on the usage of water in rice fields, on the movement of water in furrows and on drainage were conducted. Forest products investigations ranged over the structure of wood, wood chemistry, timber physics and mechanics. Food preservation investigations continued on the same lines as the previous year, but studies were also initiated on a new type of louvred van for the long-distance transport of fruit and vegetables, and on the freezing of fruit and vegetables, while fish preservation investigations were scheduled for extension by the opening of a small branch laboratory at Eden. Fruit dehydration investigations were widened to include treatment with sugar before dehydration.

The reorganisation and equipment of the Fisheries Division to undertake a comprehensive research programme was largely completed during the year, and in addition to the fisheries research vessel *Warreen* operating in Western and South Australian regions, the *Liawanee* was due to be chartered for investigations, chiefly on barracouta, school-shark and crayfish, in the Tasmanian region, while off the south-eastern continental coast increased use would be made of the *H. C. Dannevig* on the trawling grounds. A survey of the fishery resources of Papua – New Guinea was commenced with the *Fairwind* in May 1948. Much advisory work was conducted by the Division, but research on agar was suspended, although the search for new seaweed beds continued.

Industry showed a marked readiness to approach the Division of Metrology for advice and assistance in the calibration of equipment, and the position improved with regard to the basis of all measurements of length, and more particularly volumetric standardization. The Division of Electrotechnology, too, made considerable progress in establishing further electrical standards and extending the scope of its measuring facilities.

The Division of Physics continued its policy of increasing the amount of fundamental research as compared with short-term technical investigations, progress being recorded on the studies of the formation of rain, on the solar atmosphere and other phenomena; but staff shortage was a severe handicap. The Heat and Light Sections concentrated their attention on the phenomena of ice crystal formation and the attainment of very low temperatures, and on photometry respectively. Aeronautical investigations under the new Aeronautical Research Committee dealt with aircraft structures, properties of alloys, gas-turbines and high-speed flow. In the Division of Industrial Chemistry, pilot tests of a new process for the production of chromic anhydride from chrome iron ore by an acid digestion method were completed, and work on monazite, rutile, zircon and uranium ores continued, as well as on the deterioration of concrete. Among many other investigations may be cited those on Australian substitutes for linseed oil, the use of long-chain carbon compounds in the differential flotation process and detergents in wool scouring. In radiophysics the chief features of the year were work on radio-frequency emissions from the sun, cosmic noise, the ionosphere and the use of radar for surveying and navigation.

The Division of Tribophysics studied the nature of the forces restraining the movement of clean metal surfaces over each other, and the physical and chemical properties of the films of molecular dimensions used as boundary lubricants. Other departments which recorded satisfactory progress during the year are the Building Materials Research Section, the Dairy Products Research Board, and the Section of Mathematical Statistics. The report also refers briefly to research work in the Atomic Physics Section, and on the growth and rubber content of the guayule plant under Australian conditions.

VOYAGE OF THE ROYAL RESEARCH SHIP *DISCOVERY II*

THE Royal Research Ship *Discovery II*, at present in the West India Dock, Port of London, is to sail shortly on a voyage of deep-sea research, mainly in the Southern Ocean and Antarctic. This follows the departure in January of the Royal Research Ship *William Scoresby* on a ten-month voyage for investigations on oceanography and whales in South African and Australian waters (see *Nature*, January 21, p. 105). The two ships have independent programmes; but their work for the present is principally in continuation of the Discovery Investigations, formerly under the Colonial Office and now transferred to the Admiralty as a part of the National Institute of Oceanography.

The main purpose of the voyage of the *Discovery II* is to round off a general oceanographical survey of the Southern Ocean which had been nearly completed by the former Discovery Committee before the Second World War. This survey is important for two reasons: first, it gives the necessary background to investigations on whales and other oceanic life in the far south with which the Committee was specially concerned, and secondly, it is itself an important step forward in the exploration of the oceans and will give opportunities for carrying out many special investigations of basic importance to the science of oceanography.

There is a relative simplicity in the water circulation and distribution of life in the Southern Ocean, so that generalizations can often be made from fewer observations than in other regions, and principles can be established which apply to all oceans. The voyage is to last about a year and a half, and the ship will work mainly in the Indian, Australian and Pacific sectors of the Southern Ocean between subtropical waters and the fringe of the pack ice. The work, however, will not be confined to these regions, for on the outward voyage a line of deep-sea observations will be made in the little-known central Indian Ocean. The scientific work of the voyage will begin in earnest when the ship leaves Colombo and steams southward on the meridian of 90° E. At regular intervals the ship will be stopped on station, and temperature, density and chemical constituents of the water will be ascertained from the surface to the bottom, and the plankton from the surface to a depth of about 1,500 metres. The ship will call at Fremantle in July and then complete the same line of stations in the Indian Ocean, southwards to the pack ice. Thereafter she will work eastwards, carrying out similar work between ports in Australia and New Zealand and the Antarctic. These lines of deep-sea stations form the essence of the whole programme. Taken with the work done before the War, they will provide a network of observations covering the whole Southern Ocean, from which the main water-masses and currents and the various forms of oceanic life can be mapped out not only horizontally but also in vertical sections.

Many subjects will receive special attention during and between the principal lines of stations. Echo soundings will be taken wherever the ship goes, sometimes with the continuous recorder; deep cores of the sea bottom will be taken from time to time by the method used in the recent Swedish expedition in the *Albatross*, and some measurements of the depths of ocean sediments will be made with the seismic sounding-apparatus developed in recent years. Direct observations will be made on the distribution and habits of whales, and on seals, fish and birds according to opportunities. The 'convergences'—certain surface boundaries between important water masses—will receive attention, the seasonal distribution of pack ice will be studied, and there may at a later stage be opportunities to examine and chart a little-known part of the Antarctic coast.

Other work includes soundings and amendments to charts for the Admiralty Hydrographic Department, routine observations for the Meteorological Office and physiological work for the Royal Naval Personnel Research Committee.

The *Discovery II* is an oil-burning steamship of 1,036 tons (gross), specially designed as a research ship, and with some protection against ice. She was built in 1929, but in recent months has undergone an extensive refit, and is now supplied with very comprehensive equipment for deep-sea research. Her total complement is about fifty-six officers and men, including four scientific officers and three assistants. Dr. H. F. P. Herdman is the senior scientific worker in charge of the work at sea, and Commander J. F. Blackburn is in executive command. Dr. N. A. Mackintosh, director of the Discovery Investigations, will sail with the ship for the first part of the voyage.