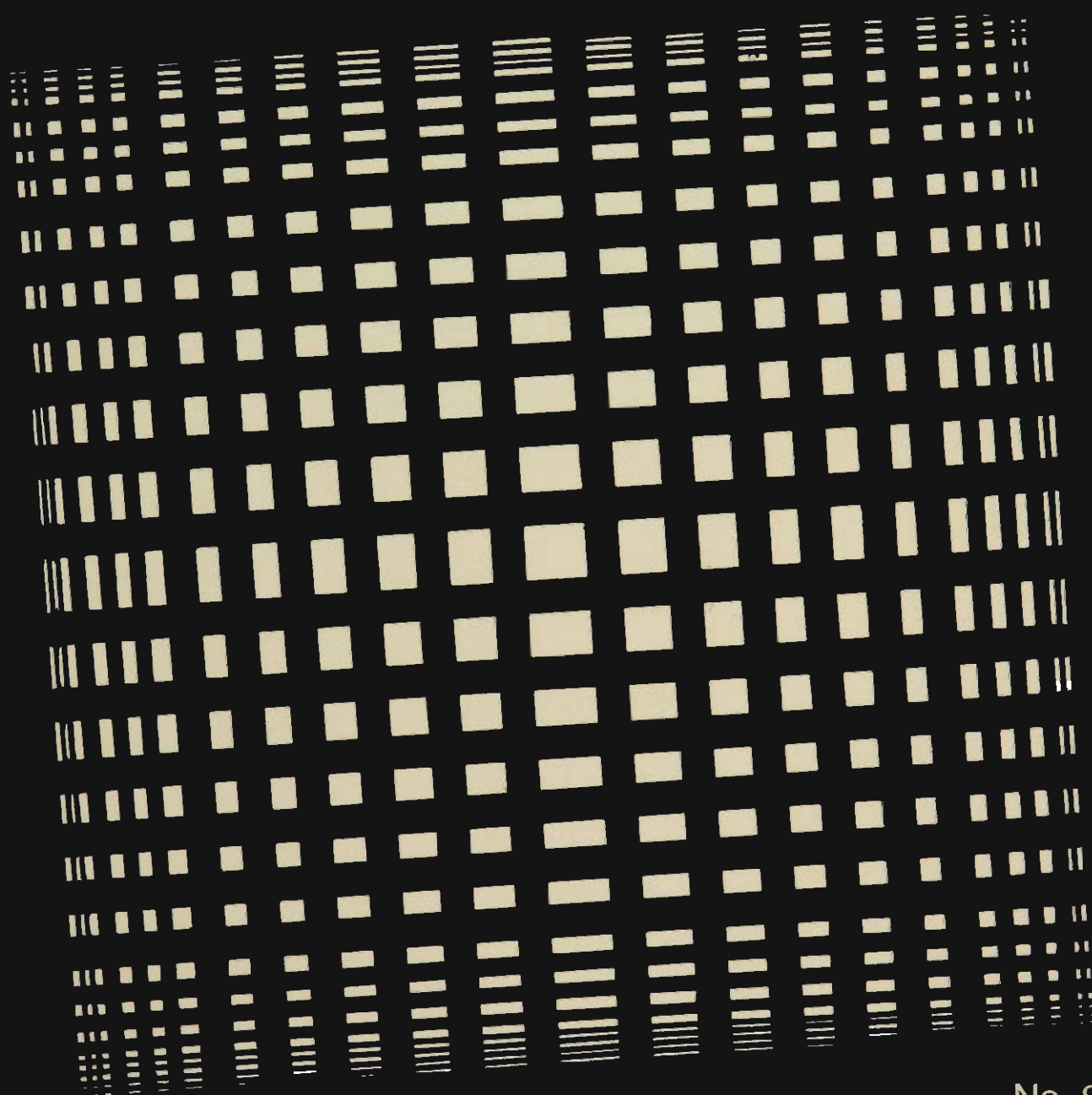


The University of New South Wales  
Wollongong University College

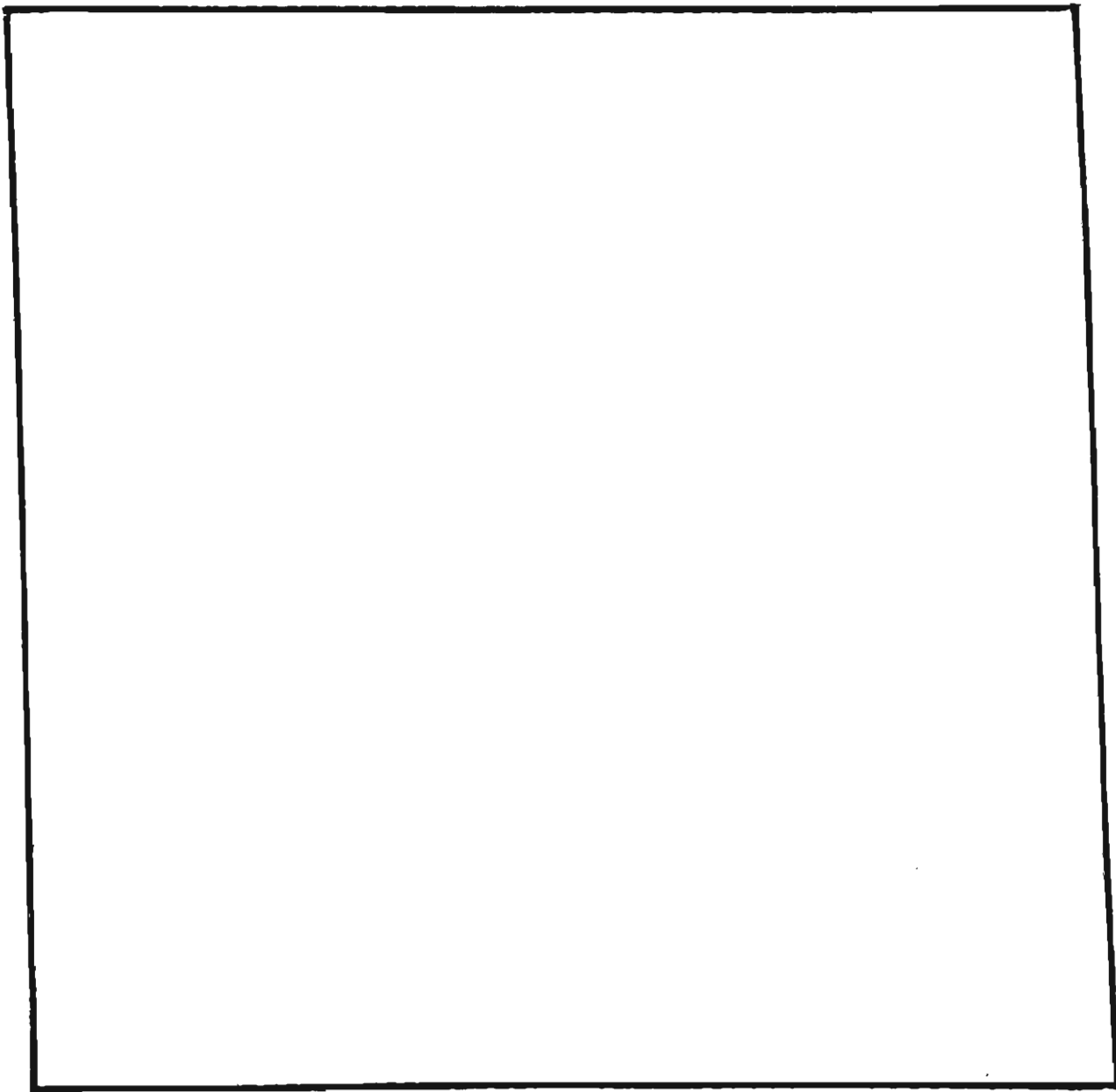
## RESEARCH REPORT 1973





The University of New South Wales  
Wollongong University College

# RESEARCH REPORT 1973





## FOREWORD

The staff of Wollongong University College have continued to develop research programmes in a diversity of disciplines during 1973. We believe that these activities are an essential part of our endeavour to ensure that the new University of Wollongong will be able to make a significant contribution to tertiary education in Australia.

The research undertaken in 1973 was mainly a continuation of projects begun in previous years. These projects cover such activities as commercial, industrial and environmental studies both in the local area and elsewhere. In addition, several new projects were commenced in 1973, including:

Studies of stability of natural slopes  
(Civil, Mechanical and Mining)

Finite Element Applications in Geomechanics  
(Civil, Mechanical and Mining)

Studies in Soil Anisotropy  
(Civil, Mechanical and Mining)

Studies of Elizabethan Sermons  
(English)

Using a recently constructed Mössbauer Spectrometer  
to study ilmenite  
(Physics)

Comparative studies in visual perception between Aboriginal  
and white children  
(Education)

Studies in cognitive growth in relation to children's  
environment  
(Education)

Studies of infant mortality in Australian urban areas  
(Geography)

Translation of the 4 volume "Zapiskii o Grazhdonskoi Voine"  
(History)

Investigation of the concept of repetition in embryology  
and its role in evolutionary theory up to 1866  
(History and Philosophy of Science)

Comparative studies of preschool children in Papua New  
Guinea and Australia  
(Psychology)

Research into the effects of the abolition of fees  
on students at Wollongong  
(Psychology)

Research into Base Metal Deposits near Mt. Isa  
(Geology)

Studies of Devonian faunas in central Victoria  
(Geology)

Concept of Revolution in the Development of Economic thought  
(Economics)

Technological change and the Growth of Cities  
(Economics)

The number of PhD candidates working on research projects in 1973 was 51 (compared with 41 in 1972) and grants and donations received for research from outside organisations totalled \$126,608 in 1975 (compared with \$140,961 in 1973).

This report provides a brief description of all the research undertaken in the College during the year.

L. Michael Birt,  
Vice-Chancellor designate.

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# GRANTS AND DONATIONS RECEIVED FROM OUTSIDE ORGANISATIONS DURING 1973.

Australian Department of Aboriginal Affairs: Joint management of a grant for the operation of the Bourke Experimental Preschool Project. (Dr. P.R. de Lacey).	\$28,500
Australian Institute of Aboriginal Studies: A study of visual perception of Aboriginal children. (Dr. P.R. de Lacey).	\$943
Australian Institute of Nuclear Science and Engineering: (Associate Professor S.E. Bonamy).	\$1,400
Australian Research Grants Committee: A critical edition of Voltaire's writings on the Calas case, to appear in T. Besterman (ed.), <u>Oeuvres completes de Voltaire</u> , Vol. 56. (Associate Professor C.P. Kiernan).	\$1,000
Australian Research Grants Committee: Desuplhurisation of Thiocarbonyl Compounds. (Dr. J. Ellis).	\$200
Australian Research Grants Committee: Determination of plant dynamics using pseudo-random test signals. (Associate Professor A.W. Roberts and Dr. W.H. Charlton).	\$3,500
Australian Research Grants Committee: Devonian Macrofossil biostratigraphy of the Lachlan Geosyncline. (Dr. A.J. Wright).	\$1,260
Australian Research Grants Committee: Diels-Alder Reaction in Heterocyclic Syntheses. (Associate Professor E. Gellert).	\$13,200
Australian Research Grants Committee: Investigation of the interaction of the alpha and gamma motor systems during phasic stretch reflex under various conditions of stimulation (Professor A.M. Clarke, jointly with Mrs. P.T. Michie and Mr. L.C.T. Glue of Macquarie University).	\$4,198
Australian Research Grants Committee: Learning rates using unisensory and bisensory presentation of information. (Dr. D.D. Diespecker).	\$502



Australian Research Grants Committee: Micro Area Boundary Probe for the Investi- gation of Discontinuities in Negative Corona. (Dr. O.J. Tassicker).	\$1,750
Australian Research Grants Committee: Queuing models and the evaluation of port capacity. (Mr. K.P. Tognetti and Dr. R. Robinson).	\$4,050
Australian Research Grants Committee: Screening for Metabolic Disorders by Gas- Liquid Chromatography and Mass Spectrometry. (Professor B. Halpern).	\$7,400
Australian Research Grants Committee: Study of heavy metals contamination of air, soil, herbage, and natural waters, in relation to environmental conditions in the Wollongong City area. (Dr. F. Beavington).	\$5,450
Australian Research Grants Committee: Substituent Effects in Acid Ionization Processes. (Associate Professor P.D. Bolton and Dr. F.M. Hall).	\$7,150
Australian Research Grants Committee: Thermal History of the Sydney Basin. A study of coal rank and mineralogical indica- tions of thermal regimes. (Professor A.C. Cook, Dr. E.R. Phillips and Dr. R.A. Facer).	\$7,522
Broken Hill Mining Manager's Association: Geological Research in Broken Hill. (Dr. E.R. Phillips).	\$812
Electrical Research Board: Electromechanical Energy Converters (Professor B.H. Smith, Dr. W. Charlton and Dr. G. Trott).	\$400
Electrical Research Board: Electric Vehicles. (Professor B.H. Smith, Dr. W. Charlton and Dr. G. Trott).	\$500
Electrical Research Board: Optimization of distribution systems. (Dr. K.J. McLean).	\$300
Electricity Commission of New South Wales: Electrostatic Precipitation of High Resistivity Fly-Ash. (Dr. Z. Herceg, Dr. K.J. McLean and Dr. O.J. Tassicker).	\$10,000

Esso Australia Inc: Esso Personnel Coal Petrology Course. (Professor A.C. Cook).	\$700
John Lysaght (Australia) Limited: Industrial accident research (Dr. N. Adams).	\$3,000
Monsanto Australia Limited: Peptide Synthesis (Professor B. Halpern).	\$500
National Coal Research Advisory Council: The use of Petrographic techniques in the Assessment of the Carbonization behaviour (Professor A.C. Cook).	\$8,000
National Health & Research Council: Development of GLC-MS techniques for Diagnosis. (Dr. Danks and Professor B. Halpern).	\$4,200
N.S.W. Department of Environment: "Detoxification and Clarification of Industrial Effluents". (Dr. J. Ellis and Dr. R.T. Wheway).	\$1,000
N.S.W. Department for Environment: Study of heavy metals contamination of air, soil, herbage, and natural waters, in relation to environmental conditions in the Wollongong City area. (Dr. F. Beavington) Main item of equipment purchased: Varian techtron 1200 atomic absorption spectrophotometer.	\$2,000
Nuffield Foundation, London: A cross-cultural study of learning and coping in young children. (Professor A.M. Clarke, jointly with Dr. L.L. Viney of Macquarie University).	\$3,071
Nuffield Foundation: Evaluation of the Geological Relationship of Australia and New Zealand in Ordovician and Devonian time. (Dr. A.J. Wright).	\$1,600
Water Research Foundation of Australia: "Detoxification and Clarification of Industrial Effluents". (Dr. J. Ellis and Dr. R.T. Wheway).	\$2,500
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	\$126,608
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GRANTS AWARDED BY WOLLONGONG UNIVERSITY COLLEGE DURING 1973.

Wollongong University College: A study of cognitive growth and environment of Aboriginal children on the South Coast. (Dr. P.R. de Lacey).	\$645
Wollongong University College: A study of environmental change and cognitive development. (Dr. P.R. de Lacey).	\$6,447
Wollongong University College: (Mr. C.J. Nightingale).	\$100
	<hr/>
	\$7,192
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## DIVISION OF BIOLOGICAL AND CHEMICAL SCIENCE

Head of Division: Professor B. Halpern,  
BSc (Syd.), PhD (Lond.), ARACI.

### ACADEMIC STAFF

#### Department of Chemistry

Professor: B. Halpern,  
BSc (Syd.), PhD (Lond.), ARACI.

Associate Professors: P.D. Bolton,  
BSc (Exon.), PhD (Lond.),  
ARIC, FRACI.  
E. Gellert,  
DrPhil (Basle), FRACI.

Senior Lecturers: J. Ellis,  
BSc (Syd.), PhD (N.S.W.), ARACI.  
(promoted 10th September, 1973).  
F.M. Hall,  
MSc PhD (N.S.W.), ASTC, ARACI.  
E. Kokot,  
BSc PhD (N.S.W.), ASTC, ARACI.

Lecturers: P.G. Burton,  
BSc PhD (Monash), ARACI.  
(commenced duty 16th July, 1973).  
W.K. Hannan,  
MSc (Syd.).  
G.M. Mockler,  
BSc PhD (N.S.W.), ARACI.  
R. Rudzats,  
MSc PhD (N.S.W.), ASTC, ARACI, ARIC.  
(commenced duty 25th October, 1973).

Senior Tutor: D.J. Campbell,  
BSc DipEd (Tas.).  
(General & Human Biology).

Post-doctoral Fellow: J.P. Warren,  
BSc PhD (Melb.), ARACI.

HIGHER DEGREE TOPICS

DEPARTMENT OF CHEMISTRY

DOCTOR OF PHILOSOPHY

D.J. Campbell - enrolled 1965: (changed from MSc to PhD in 1966)	Physiological Aspects of Acoustic Behaviour in Crickets.
Supervisor:	Dr. E. Shipp.
J. Das - enrolled 1972:	Stereospecificity of some Enzyme - Catalysed Hydrolysis Reactions.
Supervisors:	Professor B. Halpern & Associate Professor P. Bolton. (University Award).
R.D. Frier - enrolled 1970:	A Kinetic study of the Hydrolysis of N-Alkyl Acetamides (Title changed 1972).
Supervisors:	Associate Professor P. Bolton & Dr. J. Ellis. (Commonwealth Postgraduate Research Award).
I.E. Gan - enrolled 1972:	Screening for Metabolic Disorders by G.L.C. and Mass Spectrometry
Supervisor:	Professor B. Halpern.
W.K. Hannan - enrolled 1966:	Catalytic Deuterium Exchange Reactions between Alkyl- benzenes.
Supervisors:	Professor E. Gellert & Associate Professor J.K. Garnett.
A.P. Hope - enrolled 1972:	The Use of Aldehyde and Ketones as N-protecting Groups for Amino Acids in Peptide Synthesis.
Supervisor:	Professor B. Halpern. (C.S.I.R.O. Postgraduate Award).
S. Kanamori - enrolled 1972: (changed from MSc to PhD in 1973)	Water Pollution Studies on Lake Illawarra.
Supervisor:	Dr. J. Ellis. (University Award).

C.R. Pidgeon - enrolled 1971:	Thermodynamic Constants of Ionisation and Hydrolysis of Organic Compounds.
Supervisor:	Associate Professor P.D. Bolton. (Commonwealth Postgraduate Research Award).
P.G. Rowley - enrolled 1973:	Clarification and Detoxification of Effluent from the Steel Industry.
Supervisor:	Dr. J. Ellis. (Commonwealth Postgraduate Research Award).
G.M. Schier - enrolled 1973:	Sequencing of Peptides by Mass Spectrometry.
Supervisor:	Professor B. Halpern. (Commonwealth Postgraduate Research Award).
K.M. Williams - enrolled 1972:	Screening for Metabolic Disorders by Gas - Liquid Chromatography and Mass Spectrometry.
Supervisor:	Professor B. Halpern. (Commonwealth Postgraduate Research Award).

### MASTER OF SCIENCE

S. Dacko - enrolled 1972:	Thermodynamics of Complex Formation Between Tin and Halide Ions.
Supervisors:	Associate Professor P.D. Bolton & Dr. F.M. Hall.
P. Gluvchinsky - enrolled 1970:	An Investigation of the Infra Red Spectra of some transition Metal Schiff Base Complexes.
Supervisor:	Dr. G.M. Mockler.
E.J. Hanson - enrolled 1970:	Computer Techniques in Chemistry.
Supervisor:	Associate Professor P.D. Bolton.



S. Murray - enrolled 1971:	Studies of Isotopic Labelling of Amino Acids and Polypeptides.
Supervisors:	Mr. W.K. Hannan & Professor B. Halpern. (degree conferred 1973).
G.A. Ryder - enrolled 1968:	A Physico-Chemical Investigation of Some Transition Metal Complexes.
Supervisor:	Dr. E. Kokot.
R. Schibeci - enrolled 1970:	Desulphurization of Thiocarbonyl Compounds.
Supervisor:	Dr. J. Ellis. (degree conferred 1973).
J.H. Teague - enrolled 1973:	
Supervisor:	Associate Professor P.D. Bolton.

STAFF RESEARCH ACTIVITIES

## DEPARTMENT OF CHEMISTRY

1.      Natural Products:      Phytochemical investigation of the Australian and New Guinean flora, in conjunction with the Australian Phytochemical Survey, is concerned with the isolation and identification of constituents with physiological and pharmacological activity. Plants belonging to the families of Lauraceae, Annonaceae, and Asclepiadaceae and the fungus *Boletus* because of its alleged activity on the human brain, have been investigated.
2.      Synthetic Organic Chemistry:  
The development of new synthetic methods and syntheses of analogues of compounds with known antitumour and related activities are carried out in order to develop new drugs and to correlate physiological activity with chemical structure.
3.      Physical-organic Chemistry:
  - (a)      Kinetic studies of the acidic and alkaline hydrolysis of several series of aliphatic amides and ortho-substituted aryl esters have been made. Various linear free energy relationships are being used to assess the influence of substituents upon the rates, activation energies and entropies of these reactions;
  - (b)      Thermodynamic acidity constants of a wide range of substituted phenols, anilinium ions and benzoic acids have been measured by a spectrophotometric technique over a range of temperature, and values of the enthalpy and entropy of these ionization processes computed. These values are also being assessed in terms of linear free energy relationships and certain molecular orbital calculations;
  - (c)      Reaction mechanisms for the desulphurisation of organic sulphur compounds.
4.      Chemistry of organic sulphur compounds:  
The chemistry and photochemistry of thionoesters and other organic sulphur compounds is being studied and their use as intermediates in organic synthesis is being examined.

5. Inorganic Chemistry: Spectro- and magnetochemical studies of:
- (a) first row transition metal and lanthanide complexes of polydentate ligands including Schiff bases;
  - (b) polynuclear complexes of first series transition metals with benzimidazole derivatives, Schiff bases,  $\beta$ -diketones, carboxylic acids and alkoxides.
6. Catalytic Exchange Processes: Investigation into relative activities of Group 8 transition metals as heterogeneous catalysts in isotopic exchange reactions of a range of aromatic hydrocarbons, heavy water being used as a source of deuterium. The aim is to investigate the mechanisms of exchange reactions and in particular to test the worth of the  $\pi$  complex absorption mechanism.
7. Analytical Chemistry:
- (a) The determination of the configuration of asymmetric compounds by gas chromatography and mass spectrometry of Diastereoisomers is being studied;
  - (b) The circulation of water in Lake Illawarra is being studied and a water quality monitoring program established;
  - (c) Procedures for the screening of metabolic fluids by gas liquid chromatography and mass spectrometry are being evaluated.
8. Peptide Chemistry: A study of the use of ketimine derivatives of amino acids in peptide synthesis is in progress.
9. Computers in Chemistry:
- (a) Applications of on-line digital computers to chemical problems with particular reference to low resolution mass spectroscopy;
  - (b) The application of digital computers to the solution of physical and theoretical chemical problems.
10. Biology: Factors influencing the development of spatial pattern and swarming in field populations of the cricket Teleogryllus commodus are being investigated. Infradian cycles of activity and acoustical and pheromonal signalling are receiving particular attention.



PUBLICATIONS

DEPARTMENT OF CHEMISTRY

P.D. Bolton, J. Ellis, K.A. Fleming and I.R. Lantzke.

'Protonation of Azobenzene Derivatives. I. Methyl Orange and Ortho-Methyl Orange', Aust. J. Chem., 26 (1973), 1005.

R.D. Brown and P.G. Burton.

'Balance' and Predictive Capability in Approximate Molecular Orbital Theory', Chem. Phys. Lett. 20 (1973), 45.

D.R. Dakternieks, D.P. Graddon, L.F. Lindoy and G.M. Mockler.

'The Interaction of Heterocyclic Bases with Square Planar Nickel (II) Complexes of Substituted Salicylaldehydes', Inorg. Chim. Acta, 7(3) (1973), 467.

P. De Maria, A. Fini and F.M. Hall.

'Thermodynamic acid dissociation constants of Aromatic Thiols', J. Chem. Soc. Perkin II. (1973), 1969.

P. De Maria, A. Fini and F.M. Hall.

'Rate-equilibrium relationships in the nucleophilic addition of thiophenoxide ions to phenyl vinyl sulphone', La Chimica e l'Industria (Milan) 55 (1973), October.

A.G. Duff, E. Gellert and R. Rudzats.

'Flavescin: A New 1-Ketopolyhydroxypregnene from Marsdenia Flavescens', Phytochemistry, 12 (1973), 2943-2945.

J. Ellis, R.A. Eade, P. Harper and J.J.H. Simes.

'Extractives of Australian Timbers. XIII. Jinguillic Acid, a triterpene of the lupane series containing a C<sub>28</sub>+19 lactone group', Aust. J. Chem., 26 (1973), 831.

J. Ellis, E. Gellert and J. Robson.

'Synthesis of some new iodoquinolines', Aust. J. Chem., 26 (1973), 907-911.

J. Ellis and S. Kanamori.

'An Inexpensive Magnetic Stirrer', J. Chem. Ed., 50 (1973), 137.

J. Ellis, P. Rowley and R.T. Wheway.

'The Influence of Coal Washeries on the Water Quality of Receiving Streams', Proceedings of Hydrology Symposium, The Institution of Engineers Australia - Perth, August 1973.

J. Ellis and R.T. Wheway.

'Removal of Cyanides from Industrial Wastewater', Proceedings 1973 Regional Conference, N.S.W. Branch, Australian Water and Wastewater Association 3.1-13.

J. Ellis and R.T. Wheway.

'Disposal of Water Borne Coal Washery Wastes', Proceedings 1973 Regional Conference, N.S.W. Branch, Australian Water and Wastewater Association, 6.1-19.

I. Gan, J. Korth and B. Halpern.

'The Preparation of carboxylic acid methyl esters by thermal decomposition of their trimethylanilinium salts', Synthesis, (1973), 494.

E. Gellert, B. Halpern and R. Rudzats.

'Constituents of a New Guinea Boletus.II. Amino Acids and Steroids of a New Guinea Boletus', Phytochemistry, 112 (1973), 689-692.

E. Gellert and R.E. Summons.

'Steroidal Alkaloids of Marsdenia Rostrata.II. The isolation and structure of a new alkaloid, Rostratamine', Aust. J. Chem., 26 (1973), 1835-6.

B. Halpern, Y. Hoyano, V. Bacon, R.E. Summons, W.E. Pereira and A.M. Duffield.

'Chlorination Studies. IV. The reaction of aqueous hypochlorous acid with pyrimidine and purine bases', Biochem. & Biophys. Research Comm., 53 (1973), 1195-1199.

G.J. Hamilton and E. Kokot.

'Magnetic Properties of some Copper (II) Complexes of Benzimidazolylalkanols', Aust. J. Chem., 26 (1973) 997.

E. Kokot, G.M. Mockler and G.L. Sefton.

'The Magnetic Behaviour of some polynuclear methoxide complexes of Iron.(III) alkanoates', Aust. J. Chem., 26 (1973), 2105-13.

E. Kokot, G.M. Mockler and G.L. Sefton.

'Polynuclear acetylacetonatodimethoxyiron (III)', Aust. J. Chem., 26 (1973), 875.

J. Robson, J. Ellis and E. Gellert.

'The Potential of labelled iodoaminoquinolines in the diagnosis and treatment of melanoma', Nuclear Medicine, 12 (1973), 77-98.



K.M. Williams and B. Halpern.

'The use of gas chromatography-mass spectrometry for the diagnosis and study of metabolic disorders.I. The screening and identification of urinary and serum amino acids', Aust. J. Biol. Sci., 26 (1973), 831-7.

K.M. Williams and B. Halpern.

'Gas Chromatography of Amino Acids via Pyrolysis Methylation of Neopentylidene Trimethylanilinium Salts', Analytical Letters, 6(9) (1973), 839-845.



## DIVISION OF COMMERCE

Head of Division: Professor K.A. Blakey,  
BA (N.Z.), MSc (Lond.),  
MCom (Melb.), DPhil (Oxon.).

### ACADEMIC STAFF

#### Department of Accountancy

Professor: J.B. Ryan,  
MCom (Auck.), ACA, CMA (N.Z.),  
ACIS.  
(commenced duty 1st May, 1973).

Lecturers: B.H. Andrew,  
BCom (N'cle), AASA, ATIA.  
R.K. Wilson,  
BCom (N.S.W.).

Tutors: A.J. Anderson,  
BCom (N.S.W.).  
H. Crapp,  
BCom (N.S.W.).  
(commenced duty 26th March, 1973).

#### Department of Economics

Professor: K.A. Blakey,  
BA (N.Z.), MSc (Lond.),  
MCom (Melb.), DPhil (Oxon.).

Senior Lecturer: J.C. Steinke,  
MA (Calif.).

Lecturers: S. Ali,  
MCom (Melb.), DEc (Hasanuddin).  
R.G. Castle,  
MEc (Syd.).  
(commenced duty 27th February, 1973).  
D. Gallagher,  
BAgEc (N.E.)  
Mrs. Juli Irving,  
BA (N.S.W.).

Tutors: P.V. George,  
MA (Kerala.).  
(commenced duty 14th May, 1973).  
S.C. Mares,  
BEc (Prague).  
M.J. Ross,  
BA (N.S.W.).

HIGHER DEGREE TOPICS

## DEPARTMENT OF ECONOMICS

## DOCTOR OF PHILOSOPHY

R.G. Castle - enrolled 1972: Economic Implications of Particular Systems of Financing Local Government Expenditure in Urban Areas.

Supervisor: Professor K.A. Blakey.

J. Irving (Mrs) - enrolled 1969: The Tertiary Sector in an Industrial Economy.

Supervisors: Professor K.A. Blakey & Mr. J.C. Steinke.

B.W. Ross - enrolled 1969: A study of Effect of Overall System Costs on the Investment Decision in Electricity Generation.

Supervisors: Professor K.A. Blakey & Mr. J.C. Steinke.  
(University Award)

K.G. Runeson - enrolled 1973: Empirical Study of the Building Industry.

Supervisor: Professor K.A. Blakey.  
(Commonwealth Post Graduate Research  
Award)

J.C. Steinke - enrolled 1969: Decentralisation in Australia.

Supervisor: Professor K.A. Blakey.

P.J. Wilson - enrolled 1972:      Determinants of Land Use and Land  
Values in Central Areas.  
(Title changed 1973)

Supervisor: Professor K.A. Blakey.  
(Commonwealth Post Graduate Research  
Award)

## MASTER OF COMMERCE

S.C. Mares - enrolled 1972: Some Economic Aspects of Australian Immigration.

Supervisors: Mr. J. Steinke & Professor K.A. Blakey.

J.W. Martin - enrolled 1972:	An Analysis of the Factors responsible for Rising Land Prices in the Illawarra Region. (Title changed 1973)
Supervisor:	Mr. J.C. Steinke.
S.M. Martin - enrolled 1972:	Residential Location and Journey to Work.
Supervisor:	Mr. J. Steinke & W. Hotchkiss (UNSW).
M.J. Ross - enrolled 1972:	Towards a General Equilibrium Model for Port Development (Title changed 1973).
Supervisor:	Mr. D. Gallagher (Funded by Reserve Bank of Australia).
J. Scarlett - enrolled 1972:	A Reconciliation between demand for and supply of Local Public Goods. (Title changed 1973).
Supervisor:	Mr. J. Steinke.
C. Taylor - enrolled 1972:	Output of the Secondary School System related to Job Opportunities.
Supervisor:	Professor K.A. Blakey.



STAFF RESEARCH ACTIVITIES



## DEPARTMENT OF ACCOUNTANCY

The concepts of profit and capital applied in company accounts, and which ought to be so applied, continues to be a major research interest, and one of practical importance. The accountancy profession in Australia is on the verge of adopting some form of price level accounting - yet considerable research is still required to clarify the concepts traditionally employed and to assess the strengths and weaknesses of the various alternatives e.g. general purchasing power, current value concepts etc. Research is also being undertaken in areas of business finance, company taxation and the impact of a computer installation on organisational structure and the accounting function.

## DEPARTMENT OF ECONOMICS

The staff continued its programme of regional economic research, concentrating on

- (a) public investment decisions affecting natural resource use;
- (b) regional manpower development and
- (c) regional transport planning.

They collaborated with the Commonwealth Department of Labour in a regional Survey of Unutilised Labour Resources and undertook some preparatory study for a regional transport planning study to be undertaken by the N.S.W. Department of Transport. These practical studies, together with others undertaken in association with the Illawarra Regional Advisory Council, have been a stimulus to more general research in these areas by postgraduate students and staff, and have been one means (among others) of relating the teaching programme to contemporary Australian economic development.

Broader studies by staff members, which are continuing, include

- (a) a new approach to the study of poverty;
- (b) the concept of revolution in the development of economic thought;
- (c) foreign investment in Fiji, and
- (d) some aspects of economic development.

the last two projects were undertaken by staff members on overseas leave.





## DEPARTMENT OF ECONOMICS

S. Ali.

'Inflation and Economic Policy in Fiji', The Pacific Review.  
(Suva, 1973), 1-5.

D.R. Gallagher.

'The Malthusian Model of Natural Resource Scarcity: Its  
Relevance Today', Economics, 8:1 (Sydney, April 1973), 30-34.

D.R. Gallagher.

'Mathematical Economics - plurality of economic argument',  
Metropolitan Student Lecture No. 4, Economics, 8:4 (Sydney, December  
1973), 21-23.

## DEPARTMENTAL PUBLICATIONS

S. Ali.

Private Overseas Investment in Fiji, Mimeograph, Ministry of Commerce  
& Industries. (Suva, 1973), 1-31.

R.G. Castle.

'The International Monetary Crisis', Proceedings of Second Regional  
Economics Conference. (E.T.A. Sydney, 1973) 11-16.

B. Ross and P.J. Wilson.

'The Market for Rental Housing in Wollongong', Economic Research  
Bulletin 4, Department of Economics, Wollongong University College.  
(July 1973).

K.G. Runeson.

'On the Relationship Between Price and Demand', Economic Research  
Bulletin 2, Department of Economics, Wollongong University College.  
(June 1973).

J. Scarlett.

'Reconciliation of Demand for and Supply of Local Public Goods',  
Economic Research Bulletin 5, Department of Economics, Wollongong  
University College. (August 1973).

J.C. Steinke.

'Technology and Cities', Proceedings of Seminar of the Building  
Science Forum. (Sydney, November 1973), 1-8.

J.C. Steinke.

'Methods of Stimulating Growth of Country Centres', Proceedings of One Day Conference on Regional Development, (Riverina College of Advanced Education, 1973).

J.C. Steinke.

'Some Problems in the Measurement of Unemployment', Economic Research Bulletin 1, Department of Economics, Wollongong University College. (June 1973).

P.J. Wilson.

'The Relationship Between Unimproved and Improved Property Values as a Guide to Planning Urban Redevelopment', Economic Research Bulletin 3, Department of Economics, Wollongong University College. (June 1973).

## DIVISION OF ENGINEERING AND METALLURGY

Head of Division: Professor G. Brinson,  
MSc (Melb.), PhD (Sheff.),  
FIM, MAusIMM.

### ACADEMIC STAFF

#### School of Civil, Mechanical and Mining Engineering

Professor, Head of School  
and Head of Department of  
Structural Engineering: C.A.M. Gray,  
Hon. JMN, BSc ME (Syd.),  
CEng, FAIM, FIMechE,  
MICE, MIEAust, Emeritus Professor,  
University of Malaya.

#### Department of Structural Engineering

Associate Professor: R.W. Upfold,  
BE ME PhD (N.S.W.), ASTC, CEng,  
MIEAust, MIMechE  
(promoted 1st January, 1973).

Lecturers: R.N. Chowdhury,  
BSc (Eng) PGDip PhD (Liv.)  
CEng, MICE, MASCE.  
M.J. Lowrey,  
BE ME (N.S.W.), ASTC, MIEAust.  
G. Singh,  
BSc (Eng), (Alig.), MSc PhD  
(Birm.), AMInstHE, MASEE.  
(resigned 13th August, 1973).  
D.G. Montgomery,  
BSc (Eng.), PhD (Belf.),  
(commenced duty August 1973).

#### Department of Systems Engineering

Acting Head of Department  
and Associate Professor: A.W. Roberts,  
BE PhD (N.S.W.), ASTC, CEng,  
MIEAust, MIMechE.

Senior Lecturer: P.C. Arnold,  
BE, PhD (N.S.W.), CEng,  
MIEAust, MIMechE.

## Department of Thermal Engineering

Acting Head of Department  
and Associate Professor:

S.E. Bonamy,  
BE (Syd.), MSc (Birm), PhD  
(N.S.W.), ASTC, CEng, FIMechE,  
FIEAust.

Senior Lecturer:

P. Van der Werf,  
ME PhD (N.S.W.), ASTC, MIEAust.

Lecturer:

R.T. Wheway,  
BE PhD, (N.S.W.), MIEAust, MAWWA

## Department of Electrical Engineering

Professor:

B.H. Smith,  
BE PhD (Adel.), CEng, MIEE

Senior Lecturers:

W.H. Charlton,  
BE PhD (N.S.W.), ASTC, MIEE, MIEAust.

Z. Herceg,  
DiplEng (Zagreb), PhD (N.S.W.),  
MIEAust, MIREE.

K.J. McLean,  
ME (N.Z.), BD, (Melb. Div. Coll),  
PhD (N.S.W.), MIEAust.

O.J. Tassicker,  
MEE (Melb.), PhD (N.S.W.), FIEAust,  
FIEE.

Lecturer:

G.W. Trott,  
BSc BE (Adel.) PhD (Alta),  
MIEE, MACS.

## Department of Metallurgy

Professor:

G. Brinson,  
MSc (Melb.), PhD (Sheff.), FIM,  
MAustIMM

Associate Professor:

N. Standish,  
MSc (N.S.W.), PhD (Otago),  
ASTC, AMAustIMM.

Senior Lecturer:

N.F. Kennon,  
MSc PhD (N.S.W.), FRMIC, AIM,  
AMAustIMM.



Lecturers: M. Atkinson,  
BSc (Eng) (Lond.).  
T.W. Barnes,  
MSc (N.S.W.), ASTC, AIM.  
G.W. Delamore,  
BSc, PhD (Birm.).  
D.P. Dunne,  
BSc PhD (N.S.W.), AIM.  
N. Salasoo,  
BSc (N.S.W.), MSc (Pitt.),  
ASTC, AMAustIMM.

HIGHER DEGREE TOPICS

## SCHOOL OF CIVIL, MECHANICAL AND MINING ENGINEERING

### DOCTOR OF PHILOSOPHY

- M.J. Lowrey - enrolled 1972.      The Analysis and Identification of the Dynamic Properties of Three Dimensional Elasto Inertial Systems.  
Supervisors: Associate Professor A.W. Roberts & Associate Professor R.W. Upfold.
- G. Montagner - enrolled 1972.      Identification and Optimization of Bulk Granular Materials Handling Systems.  
Supervisors: Associate Professor A.W. Roberts & Dr. W.H. Charlton.  
(Commonwealth Postgraduate Research Award)
- D.E. Roach - enrolled 1970.      An Investigation of One and Two Phase Forced Flow of Granular Materials.  
Supervisor: Associate Professor A.W. Roberts.  
(Commonwealth Postgraduate Research Award)
- J.G. Symons - enrolled 1972.      Boiling Heat Transfer.  
Supervisor: Associate Professor S.E. Bonamy.  
(Commonwealth Postgraduate Research Award)

### MASTER OF ENGINEERING SCIENCE

- W.M. Benson - enrolled 1972.      Computer Modelling of Some Engineering Systems  
Supervisor: Dr. P. Arnold.
- N.T. Hodgkinson - enrolled 1967.      Dynamic Analysis of the Motion of Linkages with Relation to the Upper Extremity Limb.  
Supervisor: Associate Professor A.W. Roberts.
- R.M. Johns - enrolled 1970.      A programme for the Optimum Design of Short Span Welded Plate Web Girders to A.S. No. CAI.  
Supervisor: Associate Professor R.W. Upfold.

A.S. Kaaden - enrolled 1972.      Effect of vibration on the Flowability  
of bulk solids.  
Supervisor:      Dr. P.C. Arnold.

R. Smith - enrolled 1973.      Relationship of Bulk Solid Flow  
Properties to the Design of Bins  
(Title changed 1973).  
Supervisor:      Dr. P.C. Arnold.

The following candidates are undertaking the coursework leading to the  
degree of Master of Engineering Science:

M.G. Byrne - enrolled 1973.  
G. Demiris - ~~enro~~lled 1973.  
G.J. Edgar - enrolled 1972.  
C.A. Moodie - enrolled 1973.

#### DEPARTMENT OF ELECTRICAL ENGINEERING

#### DOCTOR OF PHILOSOPHY

W.H. Charlton - enrolled 1967.      Some Aspects of inverter-fed  
induction motors.  
(Title changed 1973).  
Supervisor:      Professor R.E. Vowels.  
(Electrical Research Board funding)  
(Degree Conferred 1973).

C.D. Cook - enrolled 1972.      Characteristics of a Twin Stator  
Induction Machine.  
Supervisors:      Professor B. Smith and Dr. W.  
Charlton.  
(Electrical Research Board and  
Commonwealth Postgraduate Research  
Award).

B.R. Lawrence - enrolled 1973.      A general method for optimum  
design of multivariable feedback  
controllers using a hybrid computer.  
Supervisor:      Dr. G.W. Trott.  
(Aust. Atomic Energy Commission).

S.S. Saleh (Miss) - enrolled 1973	An investigation of Optimum Machine Controls. (Title changed 1973).
Supervisor:	Dr. W.H. Charlton. (University Award).
L.C. Thanh - enrolled 1972. (changed from MSc to PhD in 1973)	Some Effects of Voltage Wave Form on Corona Characteristics.
Supervisor:	Dr. K.J. McLean. (University Award).

#### MASTER OF ENGINEERING SCIENCE

L.A. Humphrey - enrolled 1972.	Analysis of a Quasi two phase induction motor.
Supervisor:	Dr. W.H. Charlton. (Electrical Research Board).

The following candidate is undertaking the coursework leading to the degree of Master of Engineering Science:

M.J. Ellis - enrolled 1973.

#### MASTER OF ENGINEERING

N.D. Jones - enrolled 1972.	Control System for a Cold Reduction Steel Mill.
Supervisors:	Professor B. Smith and Dr. W. Charlton. (John Lysaght and Sons).
R.J. McHardie - enrolled 1973.	Hybrid Computer System Design.
Supervisor:	Dr. G.W. Trott.
P.J. McKerrow - enrolled 1973.	Scrapless Slitter Control Systems.
Supervisor:	Professor B. Smith. (John Lysaghts and Sons).

DEPARTMENT OF METALLURGY

DOCTOR OF PHILOSOPHY

M. Atkinson - enrolled 1970.	Assessment of Sheet Metal Formability.
Supervisor:	Professor G. Brinson.
R.H. Edwards - enrolled 1971	The Effect of Prior Deformation of Austenite on the Structure and Properties of Bainite.
Supervisor:	Dr. N.F. Kennon.
E. Kohn - enrolled 1968. (changed from MSc to PhD in 1970)	The Effect of Interstitial Solutes on Creep in Zirconium. (Title changed in 1972).
Supervisors:	Professor G. Brinson and Dr. D. Dunne. (University Award)
R. Newell - enrolled 1973.	Effect of Size and Porosity on Velocity Profile in Packed Beds.
Supervisor:	Associate Professor N. Standish.
R.L. Player - enrolled 1968.	The Effect of Oxygen on the Fracture of Iron at Elevated Temperatures.
Supervisor:	Professor G. Brinson. (B.H.P. Postgraduate Award)
I.D. Simpson - enrolled 1968.	Studies in the Distribution of Non-Metallic Inclusions in Metal Ingots.
Supervisor:	Associate Professor N. Standish.
K. Veevers - enrolled 1970.	High Temperature Fracture in Zirconium and its Alloys.
Supervisor:	Professor G. Brinson.

MASTER OF SCIENCE

B. Butler - enrolled 1971.	Kinetics of Inclusion Growth During Solidification of Metals.
Supervisor:	Dr. G. Delamore.

T.M. Miller - enrolled 1970.	Transformation of Austenite during Continuous Cooling.
Supervisor:	Dr. N. Kennon.
L. Munive - enrolled 1971.	Fluid Flow in Sinter Beds.
Supervisor:	Associate Professor N. Standish.
J. Newby - enrolled 1971.	The Role of Nitrides in the Fracture of Ferrous Alloys.
Supervisor:	Dr. D.P. Dunne.
S.J. Oakman - enrolled 1972.	The Formation of Austenite.
Supervisor:	Dr. N.F. Kennon.
N.D. Wiltshire - enrolled 1965.	The Effect of Crystallographic Orientation on the Electrochemical Properties of Tin.
Supervisors:	Professor G. Brinson and Mr. B. Harris.





## SCHOOL OF CIVIL, MECHANICAL AND MINING ENGINEERING

1.      Load Distribution in Orthotropic Bridge Decks:  
A computer programme has been written for the analysis of right orthotropic bridge decks for various load conditions using a Levy-type matrix progression technique. This is being utilized in attempts to develop improved design procedures for such structures.
2.      Dynamic Behaviour of Elastic Plate Systems:  
This project is concerned with both analytical and experimental studies of the dynamic behaviour of elastic plate systems. Such systems include, for example, flat panels with longitudinal stiffeners as occur frequently in aircraft and ship structures, corrugated-core sandwich panels, and multi-cellular bridge decks.
3.      Engineering Feasibility Study of Bellambi Boat Haven:  
An investigation has begun for the Illawarra Regional Development Committee into the feasibility of establishing a boat haven for pleasure craft at Bellambi. It is anticipated that the results of the initial theoretical analysis will be tested by a model study.
4.      The Effect of the Coastal Range on Wind:  
A Dines' Mk II Pressure Tube Anemometer has been installed at the College's Climatological Station. Continuous records of wind speed and direction obtained from this instrument will be compared with data obtained on similar instruments at Port Kembla and Lake Illawarra. From this comparison, a detailed analysis of the influence of topography on wind will be made.
5.      Improvement of Flocculation and Settlement of Insoluble Solids in Process Waters:  
As a result of an initial survey of local industries' water treatment and waste water disposal problems a priority list for research has been established. At present research is being conducted into the suspended solids problems and heavy metal contamination.

6. A Study and Investigation of Water Pollution Problems at Coal Washeries:  
Regular samples of tailings thickener underflows from local coal washeries have been analysed for particle size distribution in both the sieve and sub-sieve range. This analysis is being carried out to enable dewatering equipment to be designed. Such equipment will greatly reduce the possibility of water pollution from washery activity.
7. Boiling Heat Transfer:  
The mechanism of the various stages is being examined, both from a theoretical and experimental point of view, when heat is transferred to a flat surface submerged in a fluid at atmospheric pressure. The inclination of the surface to the horizontal will be varied so that effects of surface tension, bouyancy and other factors on bubble formation may be examined.
8. Two-Dimensional Heat Flow by Conduction:  
(i) An examination is being made of the temperature distribution in rectangular plates subject to linear temperature gradients on opposite boundaries. Generalized computer programmes applicable to various L/D ratios are being investigated.  
(ii) A study of heat flow through an-isotropic materials of irregular shape is being made using the finite element technique.
9. Bulk Handling of Granular Materials:  
The research programme deals with a number of problems broadly embraced by the analysis of conveyor performance, physical properties of agricultural products, and the mechanics of bulk material flow.  
(i) Handling and Conveying of Granular Materials:  
Performance analyses and optimization studies of grain handling systems are in progress. This work involves investigations of individual items of plant (bins, conveyors, chutes, etc.) as well as the complete handling system.

(ii) Physical Properties of Agricultural Products:

This research was concentrated in two main areas: Development of recommended techniques for the testing of convex-shaped agricultural products and impact properties of convex-shaped agricultural products.

(iii) Flow of Granular Materials:

Work is continuing on the optimization analysis of the chute flow problem. The recent emphasis in this work has been directed to "flow synthesis", the aim being to establish the form of the chute profile to achieve certain prescribed optimum conditions such as minimum travel or maximum exit velocity. Pseudo-random test signals are being used as a means of obtaining a detailed knowledge of the dynamic characteristics of the system. In the area of forced flow of granular materials a theoretical model of a single phase column of granular material elevated vertically is being developed to determine the required conveying force and pressure distribution throughout the granular column. Experiments have also been conducted on two phase flows with air as a fluidizing medium. A theory to describe this type of flow is being developed and the feasibility of a solids pump operating at fluidization investigated.

10. Road Materials Research - Skid Resistance:

An extensive and intensive study is being made into the frictional characteristics of road pavements. The investigation covers both natural and artificial materials available locally. Also within this study is the design of cement concrete and asphalt mixes with a view to making possible the use of aggregates currently rejected because of their poor wearing quality or their tendency to take a high polish.

British Standard equipment is being used to compile data on skid properties of local pavement surfaces. This data will be useful for the following purposes:

- (i) Accident studies and prevention.
- (ii) Design of horizontal and vertical alignment and design of superelevations on rural and urban roads.
- (iii) Design and determination of highway capacity.

- (iv) Traffic engineering and control.

A 'moving pavement' polishing and skidding simulator is currently being developed to study a broad range of pavement and tyre characteristics at various speeds and under various environmental conditions. A test trailer for full scale field measurement of skid characteristics is to be developed in future in order that the simulated work in the laboratory will be supplemented and correlated.

11. Materials Research Projects:

A number of problems dealing with the strength and properties of materials are under investigation. Tests are being conducted to determine the bond strength of steel and concrete for various coatings and finishes on the steel, including deformation size and geometry. Further work undertaken includes concrete and aggregate testing, unconfined and compaction tests of soils, triaxial tests, testing of failures in concrete detailed testing of corings from various mines, fatigue testing of ferro-cement. Determination of the effects on the properties of concrete by the use of epoxy additives.

12. The C.C.T.V. Camera as a Research Tool:

Techniques are being developed using the vidicon as an image multiplier for photo-elastic work. For large scale display of Moire patterns produced in stress analysis work, the C.C.T.V. is being used to give immediate patterns.

13. Stress Analysis Using Holography:

A high intensity laser is being used to develop techniques for the measurement of strain in three dimensions. Holography is being used to detect onset of cracking in concrete and mortar specimens.

14. The Analysis of Stress Distribution Produced at Abrupt Changes in Section:

The application of the complex variable to the analysis of two dimensional stress systems produced at abrupt changes in section on axially loaded members is being investigated. This method leads to a set of infinite equations in an infinite number of unknowns. Methods for the solution of these equations have been investigated using the College computer.

15.     The Investigation of Curvature Produced in Plates with Edge Loading Using Moire Fringe Techniques:  
The curvature of plates under varying types of loads and edge fixations is being investigated by interpreting Moire fringe patterns. These patterns are produced from a double exposure of reflected line patterns. A large scale apparatus, suitable for large plates, has been constructed and is being used for the study of the orthotropic properties of rolled materials.
16.     The Analysis of Whole Stress Fields Under Impact Conditions:  
Using Moire fringe techniques and high speed photographic equipment, deflections in beams and plates over large areas are being studied. This work is being carried out for impact loading and also cyclic loading.
17.     Experimental Analysis of Structures:  
Scale models of reinforced concrete and steel shell structures are being analysed. Models are also being developed for the teaching of direct and indirect model analysis techniques.
18.     The Development of High Speed Photographic Techniques:  
Various photographic techniques are being developed for the recording on film of dynamic phenomena. Techniques are developed using combinations of ultra high speed cine cameras, high intensity stroboscopes, and single shot cameras.
19.     Identification of System Dynamic Characteristics by Cross Correlation Analysis:  
The natural modes of machines on elastic supports are being determined by the application of pseudo-random perturbing signals and cross correlation analysis. Various methods for performing the correlation analysis are being investigated. Computer simulation studies of system identification investigations are being undertaken.
20.     Stability of Natural Slopes:  
A preliminary study of different factors which influence the stability of natural slopes has been made. A comparison of simple and rigorous methods of analysis for composite failure surfaces has been completed.

Some equipment necessary for the determination of residual shear strength of soil has been procured and experimental work taken in hand. Several local slopes have been studied and evidence of instability assessed in the light of known methods of analysis.

21. Finite Element Applications in Geomechanics:

Many techniques have been used to analyse problems of deformation in Geomechanics by the method of subdivision of a continuum into finite elements. Most of these techniques have proved successful for specific problems. There is little agreement concerning the general applicability of any one technique. It is difficult to prevent an abuse of the versatile Finite Element Method unless the limitations of each technique are studied and stated. A comparison of different techniques has been taken in hand.

22. Soil Anisotropy: Experiments have been conducted concerning the influence of compaction on different soil properties. In particular, the anisotropy of compacted soil has been investigated. The work is to be continued.

23. Temperature Wave Method Applied to Determining Fracture Toughness:

A method has been devised of determining the fracture toughness of material by measurement of the amount of heat emitted by the plastic work at the tip of a propagating crack. Results obtained using the temperature wave method have been shown to correlate with values calculated using the linear elastic fracture mechanics approach.

## DEPARTMENT OF ELECTRICAL ENGINEERING

1. Automatic Control:

Investigation of computer control of furnaces and rolling mills in the steel industry; investigation of various methods of switched operation of machines; identification of systems using two-level chain codes and correlation techniques.

2.      Rotating Machines: Investigations into transient performance of three-phase synchronous machines and steady state performance of inverter-fed three-phase induction machines.
3.      Processes in Electrostatic Precipitation:  
Interpretation of field testing on precipitators; the performance of full scale plant when operated with high resistivity particles; the formation of reverse ionisation and its effect on precipitator performance; forces of adhesion in agglomerate layers; mechanisms of current conduction in the precipitated layer; the effect of emitter geometry on current density and field strength.
4.      Insulating Materials:  
The complex dielectric permittivity of powders as a function of frequency and temperature; ionic and electronic conduction in insulators with special reference to the effect of metal electrodes; the force of adhesion between small diameter insulating particles in the presence of an ionic field.
5.      Gaseous Discharges:  
Generation and transport of gaseous ions in a corona discharge system with special reference to the influence of the electrode surface condition; feasibility of operation with controlled pulsed a.c. energisation; the complex dielectric permittivity of an ionised gas at various temperatures and frequencies; the measurement of the electric fields in a corona discharge by means of a special boundary micro-area probe.

#### DEPARTMENT OF METALLURGY

1.      Solidification:
  - (i)      The distribution of inclusions in ingots - a new approach to the statistical analysis of inclusion distribution in ingots has been developed and applied to both laboratory and industrial ingots. A study of the kinetics of inclusion growth is also being investigated with the aid of this statistical

analysis. The influence of convective movement in the melt on inclusion distribution is being examined.

- (ii) Solute segregation in ingots -  
Studies of solute segregation in solidified salt solutions have shown effects thought to be associated with systems that expand on solidification. These effects are being further investigated using Bi-Zn alloys.
- (iii) Grain refinement of zinc coated steel -  
Factors affecting spangle size of galvanised steel are being investigated with particular reference to the heat transfer characteristics of salt mist spray solutions. The effect of these solutions on nucleation of the zinc coating is also being examined.

2.      Packed Beds:      Studies in these systems are intended to clarify some aspects of hanging and gas distribution in blast furnaces. One aspect of the flooding work has now been completed, the results of which have led to the formulation of a new correlation for flooding which takes into account particle shape, wettability and froth formation. The study of velocity profiles and pressure drop with melting has emphasized the importance of packing arrangement in packed beds of interest to extractive metallurgy.

3.      Properties of Low Alloy Steels:
- The effects of composition and thermo-mechanical treatment on the structure and therefore the properties and potential commercial utilization of low alloy steels are being investigated by determining the influence of:
- (i)      deformation, before transformation, on the development of high strength in bainitic steels;
  - (ii)     nitride particles on the high temperature cracking of austenite;
  - (iii)    titanium and nitrogen additions on the resistance to grain coarsening at elevated temperatures of low alloy engineering steels.



4.        Structures in Plain Carbon Steel:  
Metallographic and diffraction methods are being used to investigate the influence of variables such as heating and cooling rates on the structure and properties of transformation products in plain carbon steels. These studies have particular relevance to the understanding of the origin of the complex structures in the weld zone of welded steel and thereby to the development of ways of controlling the structures and their properties.
5.        Martensitic Transformation:  
The formation of martensite in ferrous and non-ferrous systems is being studied with particular emphasis on the effect, on the transformation, of the structure and properties of the initial phase.
6.        Fracture of Iron at Elevated Temperatures:  
Electron fractographic techniques are being used to study intergranular fracture in iron strained at low strain rates at elevated temperatures. The technique allows direct measurement of the rate at which cavities are nucleated at grain boundaries during creep. Controlled additions of carbon and oxygen are made to examine the effect of solute segregated at grain boundaries and of boundary oxide inclusions.
7.        Creep of Zirconium:  
Creep fracture is being investigated in Zirconium alloys over the temperature range  $400^{\circ}$  -  $600^{\circ}\text{C}$ . Intergranular cavities are introduced by fatiguing specimens at elevated temperatures, and the development of cavitation during subsequent creep is followed using optical and electron metallography. It is hoped that this work will suggest operative creep mechanisms, and also explain why intergranular creep fracture does not occur readily in these materials.
8.        Strain Hardening:  
Reported changes of strain hardening rate during straining of low-carbon steels have been analysed to identify the conditions necessary for such behaviour and to indicate its possible origins. A range of higher carbon steels has also been studied experimentally and the analysis is being extended to account for the behaviour of these materials.

9. Computer Aided Mechanical Testing:

Mechanical testing procedures are being developed to take advantage of on-line computing facilities using a  $\pm 200\text{kN}$  capacity Dartec electro-hydraulic servo testing machine and a Nova 1200 computer. A hydraulic diaphragm bulging chamber has been coupled to the servo testing machine to provide a facility for making determinations of stress-strain relationships for sheet metals under biaxial stress and controlled strain rate.

10. Plastic Behaviour:

Analyses of stress-strain relationships under conditions of uniaxial or biaxial stress and controlled strain rates are being undertaken to assess the influences of anisotropy and strain hardening propensity on the plastic behaviour of sheet metals. Changes of strain hardening rate, during straining, are also being studied.





SCHOOL OF CIVIL, MECHANICAL AND MINING ENGINEERING

S.E. Bonamy.

'An Assessment of Professional Engineering Courses,' Wollongong University College Bulletin No. 37, Oct. 1973.

S.E. Bonamy and R.T. Wheway.

'The Influence of Heat Transfer on the Spreading of a Contract Surface in a Tube,' Proc. Aust. Conf. on Heat & Mass Transfer Item 12, May 1973.

S.E. Bonamy and R.T. Wheway.

'A Theoretical Study of Transient Wave Phenomena in Gases;' Wollongong University College Bulletin No. 36, Sept. 1973.

R.N. Chowdhury.

'Groundwater Flow Obeying Non-Darcy Laws', Proceedings International Symposium on Development of Ground Water Resources, Nov. 1973.

J. Ellis and R.T. Wheway.

'Removal of Cyanides from Industrial Wastewater', Proceedings A.W.W.A. (NSW Branch) Regional Conference - Industrial Effluents, (April 1973) 3.1 - 3.13.

J. Ellis and R.T. Wheway.

'The Disposal of Water-Borne Coal Washery Wastes' Proceedings A.W.W.A. (NSW) Regional Conference - Industrial Effluents, April 1973, 6.1 - 6.19.

J. Ellis, P. Rowley and R.T. Wheway.

'The Influence of Coal Washeries on the Water Quality of Receiving Streams' Proceedings I.E. Aust. Hydrology Symposium, Aug. 1973, 159.

M.J. Lowrey.

'Analysis of Orthotropic Folded Plates by Matrix Progression Segmental Method', Proc. 4th Australasian Conf. on Mechs. of Structures and Materials, (Aug. 1973), 145 - 151.

A.W. Roberts and P.C. Arnold.

'Research into the Conveyance and Flow of Bulk Materials' Particle Technology Research Review Vol. 1. Powder Technology Publication Series No. 3, Powder Advisory Centre, England 1973, 177 - 186.

A.W. Roberts and P.C. Arnold.

'Conveying and Flow of Bulk Materials' Particulate Matter 4:2 (1973) 15 - 18.

## Reports:

J. Ellis, P. Rowley and R.T. Wheway.

'An Investigation of Water Pollution at Coal Washeries' Report to Water Research Foundation of Australia May 1973.

D. Gallagher and R.T. Wheway (eds). Proceedings of Symposium.

'Public Health and Environmental Aspects of Water Resource Management' Wollongong University College, July 1973.

R.T. Wheway,

'1972 Annual Report of Wollongong University College Climatological Station' Wollongong University College Report No. 2 Feb. 1973.

## DEPARTMENT OF ELECTRICAL ENGINEERING

W. Charlton.

'Matrix method for the steady-state analysis of inverter-fed induction motors', Proc.IEE 120:3 (1973) 363-364. ibid. 120:9 (1973) 1015, 1016.

W. Charlton and C. Chiarella.

'An optimization example: The brachistochrone problem', Proc.IEEE 61:12 (1973), 1760 - 1761.

C. Chiarella, W. Charlton and A.W. Roberts.

'Optimum chute profiles in gravity flow of granular materials: A discrete segments solution', Trans. ASME Jour. Eng. Ind. Paper No. 73-MH-A (1973).

Z. Herceg and R.M. Huey.

'Model for Corona Modes in point-to-plane device with coated electrodes.' Proc. IEE, 120:3 (1973).

K.J. McLean and R.M. Huey.

'Influence of electric field on the resistivity of a particulate layer', Proc. IEE, 121, (1974), 78-82.

A.W. Roberts and W.H. Charlton.

'Application of pseudorandom test signals and cross correlation to the identification of bulk handling plant dynamic characteristics', Trans. ASME Journ. Eng. Ind. 95:B1, (1973) 31-36.

O.J. Tassicker and K.M. Sullivan.

'Estimation of Precipitator Performance for Collection of Fly-Ash by Examination of Low Sulphur Bore Cores', 66th Annual Meeting, Air Pollution Control Association, Chicago, June 24-28, 1973, No. 73-311.

Report:

K.J. McLean.

'Survey of Australian Experience in collecting high resistivity fly ash with Electrostatic Precipitators', (prepared for the Environmental Protection Agency, Research Triangle, North Carolina U.S.A.) Wollongong University College, 1972.

DEPARTMENT OF METALLURGY

M. Atkinson.

'Role of Laboratory Pressing Tests', Proc. of the Aust. Inst. of Metals First National Australian Sheet Forming Group Conference, Marysville, 1973.

J.S. Bowles and D.P. Dunne.

'Critical Assessment: The Crystallographic Theory of Martensite Transformation', Metal Science Journal, 7 (1973), 118.

D.P. Dunne and C.M. Wayman.

'The Effect of Austenite Ordering on the Martensite Transformation in Fe-Pt Alloys Near the Composition Fe<sub>3</sub>, Pt.I. Morphology and Transformation Characteristics', Met. Trans., 4 (1973), 137.

D.P. Dunne and C.M. Wayman.

'The Effect of Austenite Ordering on the Martensite Transformation in Fe-Pt Alloys Near the Composition Fe<sub>3</sub>, Pt. II. Crystallography and General Features', Met. Trans., 4 (1973), 149.

N.F. Kennon.

'Steel Making and Processing - An Introduction', South East Asian Iron & Steel Institute Quarterly, 2:1 (1973), 68.

N.F. Kennon.

'Nomenclature in the Metallography of Steel', J. Aust.Inst.Metals, 18 (1973), 57.

R. Newell and N. Standish.

'Velocity Distribution in Rectangular Packed Beds and Non-Ferrous Blast Furnaces', Met. Trans., 4:8 (1973), 1851.

J.A. Peart and N. Standish.

'Alkalies in Blast Furnaces - A Brief Review' in N. Standish and W-K Lu (eds.) Alkalies in Blast Furnaces, McMaster University Press, (Hamilton 1973).

D.L. Regozo, N. Standish and N.A. Warner.

'An Investigation of Wet and Dry Bulb Psychrometry in Metallic Vapor-Gas Systems,' Met. Trans, 4 (1973), 695-99.

N. Salasoo and R.J. O'Brien.

'Steel-Making and Processing 3 - Fuels and Refractories', South East Asian Iron and Steel Institute Quarterly, 2:4 (1973), 66-69.

N. Standish.

'On Flooding Criteria for Liquid Metals', Chem. Eng. Sci., 28:10 (1973), 1906.

N. Standish.

'Discussion of the FTG Process', Proc. of 32nd AIME Iron-Making Conference, Cleveland Ohio, (1973), 295-7.



## DIVISION OF LITERATURE AND LANGUAGE

Acting Head of Division: Professor A. Keane,  
MSc (Syd.), PhD (N.S.W.).

### ACADEMIC STAFF

#### Department of English

Professor: R.G.T. Southall,  
BA (Keele), PhD (Birm.).  
(commences duty 23rd February, 1974)..

Acting Head of Department  
and Senior Lecturer: Doreen M. Gillam,  
MA (Lond.).

Senior Lecturer: Dorothy L.M. Jones,  
MA (N.Z. & Adel.).  
BLitt (Oxon).

Lecturers: C.J. Nightingale,  
MA BLitt (Oxon).  
B.J. Opie,  
MA (Well.), PhD (Edin.).  
(commenced duty 27th September, 1973).

Senior Tutor: P.G. Abotomey,  
BA DipEd (W.Aust.).

Tutors: G.J. Hayes,  
BA DipEd (N'cle).  
Dianne K. Host,  
BA (Syd.).

#### Department of General Studies

Acting Head of Department  
and Lecturer: D.J. Dillon-Smith,  
MA DipEd (Syd.).



G.J. Hayes - enrolled 1971:

Attitudes to Nature in Modern  
Australian Fiction.

Supervisors:

Professor P.K. Elkin and  
Associate Professor J. Burrows.

STAFF RESEARCH ACTIVITIES

## DEPARTMENT OF ENGLISH

The major topics under investigation were:

Attitudes to Nature in Modern Australian Fiction;

Byron and the Artists: Byron's interest in art and the artists' interest in Byron;

Conventions in the Portrayal of Feminine Beauty in Sixteenth-Century Poetry;

Elizabethan Sermons: an edition;

Moral Commentary in the Novels of Samuel Richardson;

Shakespeare's Coriolanus and Political Oratory in the Early-Seventeenth Century;

The life of Joseph Furphy, Australian novelist.  
New Documents of Marcus Clarke;

The treatment of Personal Relations in Anglo-Saxon Poetry.

## DEPARTMENT OF GENERAL STUDIES

Research is continuing on aspects of the English language in the eighteenth century with particular reference to polite and vulgar usage; topics also under investigation were:

Migrant English Usage in the Wollongong Area,  
History and the Gothic Past in Eighteenth-Century England and France.



## DIVISION OF PHYSICAL SCIENCE

Head of Division: Professor A. Keane,  
MSc (Syd.), PhD (N.S.W.).

### ACADEMIC STAFF

#### Department of Geology

Professor: A.C. Cook,  
MA PhD (Cantab.)  
(commenced duty 22nd January, 1973).

Senior Lecturers: E.R. Phillips,  
BSc PhD (Qld.),  
A.J. Wright,  
BSc PhD (Syd.),  
(promoted 1st February, 1973).

Lecturer: R.A. Facer.  
BSc PhD (Syd.),

Tutors: P.F. Carr,  
BSc (Qld.),  
(commenced duty 9th July, 1973).  
B.E. Chenhall,  
BSc PhD (Syd.),

Professional Officers: B.K. Johnston,  
BSc Met. (N.S.W.), BSc Geol. (N.S.W.).  
(commenced duty 10th December, 1973).  
H.L. Roberts,  
BSc (N.S.W.),  
(commenced duty 16th April, 1973).  
K.M.J. Wright,  
BSc (Syd.),  
(resigned April, 1973).

#### Department of Mathematics

Professor: A. Keane,  
MSc (Syd.), PhD (N.S.W.).

Senior Lecturers: A.E. Chapman,  
MSc (Lond.),  
D.J. Clarke,  
BSc (W.Aust.) MSc (Adel.),  
PhD (N.S.W.).

P. Suryanarayana,  
BSc (And.), MA (Madr.) PhD (Calif.).

K.P. Tognetti,  
BE MEngSc (N.S.W.) FACS AMORSA.

Lecturers: M.W. Bunder  
BSc (N.S.W.), MA (N.E.), PhD (Amst.).

G. Doherty,  
PhD (N.S.W.).  
(commenced duty 1st November, 1973).

C.M. Gulati,  
MA (Delhi), MSc (New Mexico State)  
PhD (Carnegie Mellon).

T.S. Horner,  
BSc DipEd (Syd.).

A.G. Morris,  
BSc (Newcastle),  
(commenced duty 16th July, 1973).

P. Pentony,  
PhD (A.N.U.).

Senior Tutor: F.P. Prokop,  
BS MA (Detroit),  
(commenced duty 16th April, 1973).

Tutors: P.T. Castle,  
MSc (N.S.W.).  
F. Hille,  
DipPhysics T.U. (Braunschweig), DIC.  
P.J. Bardsley,  
BSc (A.N.U.).  
(commenced duty 19th February, 1973).

#### Department of Physics

Professor: P. Fisher,  
BSc PhD (W.Aust.).  
(commences duty 1st July, 1974).

Acting Head of Department  
and Senior Lecturer: K.J. Ausburn,  
BSc (Syd.), MSc (Lond.), PhD (N.S.W.),  
DIC MInstP.

Senior Lecturer: J.N. Stephens,  
MA (Cantab.), PhD (N.S.W.), AMInstF,  
AInstP, AAIP, IOMEPS, CEng, FRAS.



Lecturers: J.N. Mathur,  
MSc (Alig.), DrRerNat. (Kiel),  
AAIP, IMEPS, MDPG

A.I. Segal,  
BSc (Melb.), Grad AIP

Tutors: J.L.K. Lising,  
BSc (N.S.W.), Grad AIP.

N.L. Montgomery,  
BSc (N.S.W.), Grad AIP.

G.K.G. Moore,  
BSc (N.S.W.), Grad AIP.



## DEPARTMENT OF GEOLOGY

### DOCTOR OF PHILOSOPHY

G.R. Carr - enrolled 1973.

A study of a base metal-ore deposit in the Mt. Isa region.

Supervisors:

Professor A.C. Cook and Dr. E.R. Phillips.  
(Commonwealth Postgraduate Research Award).

M.J. Garratt - enrolled 1973.

Late Silurian to early Devonian faunas of central Victoria.

Supervisor:

Dr. A.J. Wright.

K.R. Johnson - enrolled 1969.

The relation of the structural evolution of the Macquarie Syncline to Sedimentation in the Moon Island Beach Sub-group, N.S.W.

Supervisors:

Professor A.C. Cook and Dr. E.R. Phillips.  
(Commonwealth Postgraduate Research Award).

G.C. Smith - enrolled 1973.

Low-grade metamorphism in sedimentary sequences.

Supervisors:

Professor A.C. Cook and Dr. E.R. Phillips.  
(Commonwealth Postgraduate Research Award).

### MASTER OF SCIENCE

J.H. Callender - enrolled 1972.

A study of the post-Permian quartzites of southern N.S.W.

Supervisors:

Professor A.C. Cook and Dr. E.R. Phillips.

DEPARTMENT OF MATHEMATICS

DOCTOR OF PHILOSOPHY

N.W. Bennett - enrolled 1968.	Development of Language for use in conversing with a Digital Computer via a Remote Terminal.
Supervisor:	Professor A. Keane.
M. Brooks - enrolled 1973.	Topic not yet determined.
Supervisor :	Dr. D.J. Clarke.
T.S. Horner - enrolled 1966. (changed from MSc to PhD in 1972)	A correction to the Narrow Resonance Approximation to the Calculation of Resonance Absorption.
Supervisor:	Professor A. Keane.
J.P. Louis - enrolled 1972.	Edge Waves.
Supervisor:	Dr. D.J. Clarke. (Commonwealth Postgraduate Research Award)
D.J. McKeegan - enrolled 1968.	The Doppler Broadening of Resonance Profiles for fuels in the Solid State.
Supervisor:	Professor A. Keane.
K.J. Maher - enrolled 1968.	The Theory of Neutron Wave Propagation in Solids and Liquids.
Supervisor:	Professor A. Keane.
A.G. Morris - enrolled 1970.	Eigenvalues by Numerical Methods. (Title Changed 1973).
Supervisor:	Mr. T. Horner. (Commonwealth Postgraduate Research Award)
J.P. Pollard - enrolled 1967.	Numerical Methods used in Neutronics Calculation.
Supervisor:	Professor A. Keane.
R.W. Wilcox - enrolled 1971.	Oscillations of a Fluid on a Rotating Earth.
Supervisor:	Dr. D.J. Clarke.

## MASTER OF SCIENCE

J.N. Bevan (Miss) - enrolled 1973. Optional Allocation.

Supervisor: Dr. C. Gulati.

J. Korth - enrolled 1972.

Application of Transfinite  
Numbers and Infinitesimals.

Supervisor: Dr. M. Bunder.

The following candidates are undertaking the coursework leading  
to the degree of Master of Science (Operations Research).

C.G.R. Brett - enrolled 1971.

J.E. Casey - enrolled 1971.

L.F. Halimah (Miss) - enrolled 1972.

J.M. Hogg - enrolled 1971.

J.J. Jones - enrolled 1972.

T.R. Munster - enrolled 1973.

B.E. Murray - enrolled 1971.

A.N. Preston - enrolled 1973.

P.J. Reed - enrolled 1972.

R.F. Robinson - enrolled 1973.

P. Wakenshaw - enrolled 1973.

## DEPARTMENT OF PHYSICS

## DOCTOR OF PHILOSOPHY

J. Caruana - enrolled 1972:

Angular Distribution of Fission  
Fragments.

Supervisor:

Dr. J.N. Mathur.  
AINSE Research Scholarship.

S. Whittlestone - enrolled 1973: The Energy Spectrum of Neutrons  
in a Pulsed Fast Assembly.  
Supervisors: Professor A. Keane and Dr. J.  
Mathur.

## MASTER OF SCIENCE

B.P. Carroll - enrolled 1972: Time Variations in Stellar  
Brightness.

Supervisor: Dr. J.N. Stephens.

W. Djuricic - enrolled 1970: The Performance of Infra-red  
Photographic Emulsions with  
particular reference to  
Astronomical Applications.

Supervisor: Dr. K.J. Ausburn.

B.M. Harper - enrolled 1971. Scattering of Light by Solids.

Supervisor: Dr. K.J. Ausburn.

J.L.K. Lising - enrolled 1966. The Application of the Mossbauer  
Effect to the Study of Some  
Magnetic Properties of Ilmenite.  
(Title changed 1971).

Supervisor: Dr. K.J. Ausburn.

G.K.G. Moore - enrolled 1970. A Survey of Infra-red Astronomical  
Objects.

Supervisors: Professor R. Giovanelli and Dr.  
K.J. Ausburn.

P.W. Thompson - enrolled 1969. Infra-red Detectors.

Supervisor: Dr. K.J. Ausburn.

B.R. Wade - enrolled 1972. A Tracking System for the Wollongong  
University College 18 Inch Telescope.

Supervisor: Dr. K.J. Ausburn.

R.L. Walsh - enrolled 1970. Neutron Emission from Fission  
Fragments.

Supervisors: Dr. J. Mathur and Dr. Symonds.



STAFF RESEARCH ACTIVITIES



## DEPARTMENT OF GEOLOGY

### 1. Research Interests:

Research in the Department of Geology has continued to be concentrated on the broad fields of coal geology, petrology, stratigraphy and magnetic studies in geophysics - but has recently been extended into other aspects of mineral resources. Mathematical aspects of geology are emphasized in many phases of research.

### 2. Coalfield Geology:

Coal geology investigations cover a broad spectrum of interest. Coal petrographic studies, including studies of both coal seams and rocks containing carbonaceous matter, from a number of coal basins in Australia are carried out. Most research has been concentrated on an investigation of the thermal history of the Sydney Basin (an A.R.G.C. - funded project) and on the carbonization properties of coals (an N.C.R.A.C. - funded project). The results of the research have applications in the field of oil exploration and in the design of blends for the production of metallurgical coke. Both of these aspects have implications relating to resource discovery and utilization. Equipment purchased for this research has included precision reflected light microscopes and a microscope photometer for detailed study of coal reflectivities.

### 3. Petrology:

Petrological studies have included investigations of granites, and of granitic gneisses and other metamorphic rocks from Broken Hill, N.S.W. This research is funded in part by the Broken Hill Mining Managers' Association. The data gained is assisting in the elucidation of the geological setting and history of one of the world's most important base metal deposits. Microtextural features, such as myrmekite and metamorphic textures, have been used in studies of the genesis of the metamorphic rocks. Other petrological research has included study of igneous and sedimentary rocks from the Wollongong-Kiama district of N.S.W. This research is assisting in the investigation of the history of the Southern Coalfield.

4. Palaeontology and Stratigraphy:

Palaeontologic and stratigraphic research has been concentrated in two main areas. One topic, financed by the A.R.G.C., concerns various aspects of Devonian biostratigraphy in the Lachlan Geosyncline of N.S.W. An important aspect of this research has been detailed treatment of silicified faunas from limestones. The other sphere of research, supported by a grant from the Nuffield Foundation, involves a study of the previous relationships of Australia and New Zealand. In relation to the latter research, a specialized Aristophot photographic unit for photography of characteristic fossils has been purchased.

5. Magnetic Studies (Geophysics):

Geophysical research is concerned mainly with the investigation of the magnetic properties of rocks. In particular, rock magnetism and palaeomagnetism are being used to develop a magnetic stratigraphy of rocks of the Sydney Basin (part of an A.R.G.C. - funded project). This work is capable of providing correlation horizons within the Basin which are not otherwise available.

The role of palaeomagnetic data in the theories of plate tectonics and continental drift is also being assessed.- palaeomagnetism being the most important type of evidence currently used in the study of past continental configurations.

In addition to the research outlined above, the following research is being conducted by post-graduate students of the Departments:-

Post-Permian quartzites of southern New South Wales:

Research into the nature and the genesis of post-Permian quartzitic rocks, and in particular research is concerned with the use of these deposits in the refractories industry.

Base Metal deposits near Mt. Isa:

Research into the nature and the genesis of important 'sedimentary' sulphide deposits. This study should provide useful information on a most significant type of ore deposit.

Devonian faunas of central Victoria:

Research into Devonian marine faunas, and the use of the data obtained in elucidating the geological history of south eastern Australia.

Structure and sedimentation in the Hunter Valley Coalfield:

This research is directed towards structural evolution of the Macquarie Syncline and its relationship with sedimentation in the Moon Island Beach Subgroup. This study is oriented towards computer analysis of the data and is a significant contribution to knowledge of the processes associated with coalfield formation.

Low-grade metamorphism in sedimentary sequences:

Research is directed towards an understanding of the changes in the mineralogy and the organic constituents associated with diagenesis and burial metamorphism of sedimentary rocks. This research will provide significant data concerning economic mineral deposits (especially fuels) in sedimentary rock sequences.

DEPARTMENT OF MATHEMATICS

1. Numerical Analysis:

The LR and QR algorithms for finding eigenvalues and eigenvectors of a matrix have been applied to further special cases. The calculation of nodes and weights of Gaussian integration formulae has been examined indirectly as a problem in calculating eigenvalues and eigenvectors of an appropriate matrix.

2. Physical Oceanography:

Aspects of edge waves, both theoretical and experimental, have continued to be examined. The properties of the group velocity of these waves have been analysed for typical continental profiles. Experimental considerations of both edge waves and Kelvin waves have been made in the Gulf of Carpentaria and the east coast of Australia. A similar study is planned for the west coast of Australia where there are unusual topographic features.

Significant results have also been obtained for the flow of long waves over submerged barriers and plates, and further work is required in the practical usage of same.

Intensive study of numerical modelling techniques for the long wave hydrodynamic equations has shown that both implicit and explicit finite difference schemes may lead to severe distortion effects in the propagation of waves in channels and bays. Means of improving the convergence of an initial boundary value problem for the forced oscillations of seas have been obtained. Propagation of tides in oceanic areas are under investigation with particular emphasis to the  $M_2$  tide in the Bay of Biscay where the Coriolis effect is variable and the continental slope is extremely steep.

Barotropic waves are now being studied with respect to variations in bottom topography and the vertical density profile in order to ascertain the variations in deep current meter records obtained in the eastern North Atlantic.

3. Queueing Problems: Comparison of single server and two homogeneous servers, with traffic intensity held fixed, is being carried out for various queue disciplines. Comparison of two heterogeneous servers with two homogeneous servers is being considered. In particular, it is of interest to obtain optimal service rates for two servers. When an analytical solution is hard to obtain, simulation techniques will be used.
4. Reactor Physics: Various aspects of resonance absorption and thermalisation have been considered, including crystal binding and resonance overlap. It would appear that crystal binding has little effect on the overall absorption but could be significant in the calculation of Doppler coefficients. However, the assumptions that have been made throw doubt on the accuracy obtained for this second order effect.

The programme ZHEX has been written to compute the individual channel flux and power distributions of fast reactors of current design. This involves the solution of the neutron diffusion equation in hexagonal-z geometry with an arbitrary number of downscattering energy groups. The finite difference equations are solved by successive block over relaxation with regional rebalancing. A programme DXYZ has been written to solve the neutron diffusion equation in x, y, z geometry with an arbitrary number of energy groups. Up-scattering is permitted and the finite difference equations are solved by successive plane over-relaxation with regional and energy rebalance. DXYZ has been used in the analysis of recent experiments on the Australian Atomic Energy Commission critical facility at Lucas Heights.

5.      **Logic:**                   Research into the applications of Nonstandard Arithmetic to measure theory continues. A paper in this was presented to "Logic 74" a conference on Recursive Model Theory at Monash University. Extensions of and improvements to the methods used are still being sought.
  
6.      **Number Theory:**       A paper was prepared on a system of commutative nonassociative arithmetic. Various interpretations for this as well as for noncommutative, nonassociative arithmetic were included.
  
7.      **Neutron Capture:**      Work is in progress on two projects in association with the Physics Division of the Australian Atomic Energy Commission.  
  
          (i)                   An investigation of the neutron capture reaction in Chlorine with incident neutron energies in the resonance region;  
  
          (ii)                  A study of single particle effects that manifest themselves in the neutron capture reaction throughout the mass region  $20 < A < 140$ .
  
8.      **Lattice Theory:**       The theory of neighbourhood and ideal lattices has been formulated as a generalization of a topological space. Continuous lattice functions and lattice homeomorphisms have been defined and their properties examined.

9. Functional Analysis:

Work in the following areas is in progress:

- (i) Complete sequences in normed linear spaces and their stability;
- (ii) Non-linear evolution equations;
- (iii) Applications of "Numerical range" in Banach spaces.

10. Group Theory:

Work in this area includes calculation of the laws of some relatively free nilpotent groups of low rank and study of the lattice of torsion free nilpotent varieties of groups.

DEPARTMENT OF PHYSICS

Investigations of infra-red detectors for astronomical application continued. An 18-inch Newtonian infra-red stellar telescope has been brought into operation initially with infra-red photographic plates as the detectors. Mossbauer spectroscopic investigations of some magnetic minerals continued.

The fission fragment distribution, intrinsic structure effects in fissioning nuclei, intermediate structure, and isomeric fission were investigated in collaboration with Physics Division, Australian Atomic Energy Commission, Lucas Heights.

A pneumatic and hydraulically controlled Mossbauer spectrometer acting in the constant velocity mode has been constructed and has proved very effective in studying the detailed Mossbauer spectra of ilmenite and its oxidised forms. The results of this investigation are about to be published.

Photometric observations at the Cassegrain focus of the University's 18 inch telescope received a set-back when over \$4000 worth of equipment was stolen over Christmas 1973. Despite this, work is continuing and a photometer set up on the 10 inch telescope has been used to obtain photometric data of globular clusters. One of the few photographs obtained in the southern hemisphere of the elusive comet Kohoutek was also obtained at the Newtonian focus of the 18 inch telescope.

Research in conjunction with the Australian Atomic Energy Commission on the angular distribution of fission fragments and the neutron-induced fission capture cross-section of heavy nuclei is continuing. X-ray measurements for the determination of the nuclear charge of fission fragments is also being undertaken.

A grant has been received from the A.R.G.C. for research in conjunction with members of the Kensington campus on acoustical transient phenomena in musical instruments.

With the advent of our foundation professor of physics, Professor Fisher, it is expected that a new research activity, the spectroscopic study of the symmetries and deformation - potential constants of impurities in semi-conductors, will be undertaken.

Preliminary studies of the equipment needed for this research are in progress.

PUBLICATIONS



DEPARTMENT OF GEOLOGY

G.R. Carr and E.R. Phillips.

'On exsolution myrmekite', Science and Culture, 39 (1973), 516-517.

A.C. Cook.

'Reserves of coking coal in New South Wales', Search, 4 (1973), 16-20.

A.C. Cook in R.N. Banerjee, A.C. Cook and G.E. Edwards.

An Introduction to Coal Petrology - A Technique for the Australian Coal Industry, (Sydney, 1973).

R.A. Facer.

'The New Global Tectonics', Age of linear magnetic anomalies of ocean basins: Discussion", Bull. Amer. Assoc. Petrol Geol., 57 (1973), 1134-1137.

R.A. Facer.

'Reconnaissance "Magnetic Logging" of diamond drill cores from the Sydney Basin, New South Wales', Bull. Aust. Soc. Exploration Geophysicists, 4:4 (1973), 1-17.

R.A. Facer.

'Stable magnetization in a gabbro from the Giles Complex, central Australia', Can. J. Earth Sciences, 10 (1973), 1685-1687.

K.R. Johnson and A.C. Cook.

'Cyclic characteristics of sediments in the Moon Island Beach Subgroup, Newcastle Coal Measures, New South Wales', Math. Geology, 5 (1973), 91-110.

B.G. Jones.

'Sedimentology of the Upper Devonian to Lower Carboniferous Finke Group, Amadeus and Warburton Basins, Central Australia,' J. Geol. Soc. Aust., 20 (1973), 273-293.

E.R. Phillips,

'Myrmekite of exsolution and replacement origins - a discussion', Geol. Mag., 110 (1973), 74-77.

E.R. Phillips,

'Myrmekites from the Haast Schists, New Zealand: a discussion', Am. Mineralog., 58 (1973), 802-803.

E.R. Phillips and G.R. Carr.

'Myrmekite associated with alkali feldspar megacrysts in felsic rocks from New South Wales', Lithos 6 (1973), 245-260.

A.J. Wright and E.D. Ghent.

'A metamorphosed coral in an olivine-bearing hornfels from New South Wales,' J. Geol. Soc. Aust., 20 (1973), 79-84.

A.J. Wright in A.J. Boucot et al.

'Biogeographic relations of the pre-late Middle Devonian of the eastern Klamath Belt, northern California' (Abstract), Geol. Soc. Am. Absts. Programs, 15:1, (1973), 14.

A.J. Wright in A.J. Boucot et. al.

'Pre-Late Middle Devonian biostratigraphy of the eastern Klamath Belt, northern California (Abstract)', Geol. Soc. Am. Absts. Programs, 15:1 (1973), 15.

#### DEPARTMENT OF MATHEMATICS

M.W. Bunder.

'A Generalised Kleene-Rosser Paradox', Notre Dame Journal of Formal Logic, (1973), 53-54.

M.W. Bunder.

'A Deduction Theorem for Restricted Generality', Notre Dame Journal of Formal Logic, (1973) 341-346.

D.J. Clarke.

'Seiches in Jervis Bay, N.S.W.: theory vs. experiment', Wollongong University College Bulletin No. 27 (Wollongong 1971).

## DIVISION OF SOCIAL SCIENCE

Head of Division: Professor R. Duncan,  
MA (Adel.).

### ACADEMIC STAFF

#### Department of Education

Acting Head of Department  
and Senior Lecturer: Dr. B.V. Hill,  
BA BEd (W.Aust.), MA (Syd.), MACE  
(resigned 31st December, 1973).

Senior Lecturer: P.R. de Lacey,  
BSc (N.S.W.) MA (Auck.), PhD  
(N.E.), MAPsS, MACE.

Lecturer: J.M. Jones,  
BEd, (Qld.), MA (Victoria B.C.),  
(commenced duty 2nd September, 1973).

#### Department of Geography

Professor: M.G.A. Wilson,  
MA (N.Z.) & (Wisconsin)  
PhD (Melb.),  
(commenced duty 12th December, 1973).

Senior Lecturers: F. Beavington,  
BA PhD (Lond.), MSc (Aberd.),  
CertEd (Cantab.).

R. Robinson,  
BA (N.E.), MA DipEd (N.S.W.),  
PhD (Br.Col.).

Lecturers: E. Dayal,  
MA PhD (Delhi).

R. Young,  
MA (Syd.).

Tutor: Ann R.M. Johnson,  
BSc (Syd.).

Department of History

Professor: R. Duncan,  
MA (Adel.).

Associate Professors: J.S. Hagan,  
BA DipEd (Syd.), PhD (A.N.U.).  
(promoted 1st January, 1973).  
C.P. Kiernan,  
MA (Cantab) & (Melb.), PhD (N.S.W.).

Senior Lecturer: A.M. Healy,  
BA (Syd.), PhD (A.N.U.).

Lecturer: E.P. Johnston,  
BA (Wales).  
(commenced duty 21st May, 1973).

Tutors: Mrs. Josephine A.Castle,  
BA (Syd.),  
P.G. Fidlon,  
BA (N.S.W.), PhD (Lond.).  
(commenced duty 2nd March, 1973).

Department of H.P.S.

Acting Head of Department  
and Lecturer: J.R. Panter,  
BA (Adel.).

Lecturer: E. Richards,  
BSc (Qld.).  
(commenced duty 5th March, 1973).

Tutor: C.H. Fisher,  
BA MA (N.S.W.).  
(appointed Feb. 1973 - resigned  
31st December, 1973).

Department of Psychology

Professor: A.M. Clarke,  
BA (N.S.W.), PhD (A.N.U.) ASTC,  
FAPsS.  
(commenced duty 3rd April, 1973).

Senior Lecturer: J.L. Morris,  
BA BCom DipEd DipPsych (Melb.),  
EdD (Calif.), MAPsS, MACE.

Lecturers: N.L. Adams,  
BSc PhD (N.S.W.) MAPsS.  
D.D. Diespecker,  
BA PhD (N'cle, N.S.W.), MAPsS.  
B.M. Walker,  
BA (Syd.).  
(commenced duty 16th April, 1973).

Tutors: C.G. Cupit,  
BA (Syd.).  
J.M. Freestone,  
BA (N.S.W.).  
(commenced duty 2nd April, 1973).

HIGHER DEGREE TOPICS

## DEPARTMENT OF GEOGRAPHY

### MASTER OF SCIENCE

A.R.M. Johnson - enrolled 1972:      Weathering characteristics of  
Slopes in the Wollongong Area.  
Supervisors:      Dr. F. Beavington and Dr. R.N.  
Chowdhury.

## DEPARTMENT OF HISTORY

### DOCTOR OF PHILOSOPHY

T.A. Cutler - enrolled 1971:  
(changed from MA to PhD 1972)      History of Australasian Meat  
Industry Employees Union.  
(Title changed 1973).  
Supervisor:      Professor R. Duncan.  
(University Award).

K. Davies - enrolled 1972:  
(changed from MA to PhD 1973)      A History of Syllabuses in History  
and Social Studies in N.S.W.  
Schools 1880-1950.  
Supervisor:      Associate Professor C.P. Kiernan.

D.J. Dillon-Smith - enrolled 1973:      History and the Gothic Past in  
Eighteenth Century England and  
France.  
Supervisor:      Associate Professor C.P. Kiernan.

### MA PASS

J.E. Bates - enrolled 1971: .

T.J. Cliff - enrolled 1973:      Withdrawn.

M.L. Dains (Mrs) - enrolled 1971:

R.P. Johnston - enrolled 1972:      Completed Coursework 1973.  
Degree Conferred.

F.X. Larkin - enrolled 1972:

V. Owen (Miss) - enrolled 1973:

S.E. Wakeman (Mrs) - enrolled 1973:

## DEPARTMENT OF PSYCHOLOGY

### M.A. HONS.

C.G. Cupit - enrolled 1970:      Motivational correlates of risk taking.

Supervisor:      Dr. J.L. Morris.

E. Kolokotronis (Miss) -      Learning and performance in women.  
enrolled 1973:

Supervisors:      Professor A.M. Clarke and Dr. D.D.  
Diespecker.  
(W.U.C. postgraduate award).





STAFF RESEARCH ACTIVITIES

## DEPARTMENT OF EDUCATION

1. Surveys of cognitive growth in relation to children's environment in New South Wales.
2. Influences on the socialization of children.
3. Studies in compensatory education at preschool and primary school levels.
4. A study of differences in visual perception between Aboriginal and white children.
5. A survey of vocational aspirations of sixth-form pupils in relation to the teaching profession.

## DEPARTMENT OF GEOGRAPHY

1. An investigation of soil, water and vegetation contamination by heavy metals in the Wollongong area.
2. The development of market gardening in England from Parliamentary Inclosure to the mid-twentieth century.
3. Fluvial and coastal geomorphology of the South Coast of New South Wales.
4. An investigation of slopes in the Wollongong area.
5. Markov chain analysis of shipping linkages in the port of Port Kembla; queuing analysis.
6. Factor analysis of socio-economic variables in the urban Illawarra; residential land prices.
7. Pressure of cattle population in India; a spatial analysis.
8. Changing structure of dairy farming in the Illawarra.
9. Infant Mortality in Australian urban areas.

10. Urban factorial ecology in Suva, Fiji.
11. Analysis of turn-round time in the ports of Hong Kong and Singapore.

#### DEPARTMENT OF HISTORY

Research continues on Enlightenment, Revolution and Science in French and British thought in the eighteenth century. Other projects include: Late nineteenth-century immigration into New South Wales from the United Kingdom; the career of Sir Winston Churchill; a quantitative approach to the analysis of consideration and legislative functions of the House of Commons; Various aspects of Australian social history in the nineteenth century and twentieth century, including trade unions, arbitration laws, education, the history of the labour movement and the status of women; the activities of British skilled craftsmen in the nineteenth century; the social backgrounds of Italian immigrants to Australia; colonial education policies in southeast Asia; intercultural problems in colonial areas, with particular emphasis on the history of native administration and industrial development in Papua-New Guinea; the history of modern racist ideology and practice; the full-scale life of A.A. Toffe (project in conjunction with U.S. colleagues to shed light on the lives of early Soviet leaders); translating and editing the four volume "Zapiskii o Grazhdonskoi Voine" by Antonov-Ovseerov - a major source in the Russian Revolution and Civil War.

#### DEPARTMENT OF HISTORY AND PHILOSOPHY OF SCIENCE

1. A study of nineteenth century scientific method with particular reference to the Preliminary Discourse of Sir John Herschel, attitudes to the philosophy of Sir Francis Bacon and the use of the term 'induction'.

2. Research on the concept of repetition in embryology and its role in evolutionary theory in England up to 1866. Includes an analysis of the origin of the concept in German Romantic philosophy of the early nineteenth century, and its subsequent evolutionary applications by various authors such as Robert Chambers, Robert Knox, Herbert Spencer, Richard Owen, Charles Darwin and Ernst Haeckel.
3. A project dealing with problems of the coal-mining industry in the Illawarra district, 1880-1900.

#### DEPARTMENT OF PSYCHOLOGY

1. The development of an apparatus to provide four channels of information to a vibrotactile unit and to a visual display panel. The displays are to be arranged in an instrument console which stimulates an industrial control environment. The information is to be continuously variable.
2. The development of a pictorial vocational interest inventory. The instrument is compatible with a series of picture interest inventories produced in some seven nations by Harold Geist and his collaborators.
3. An investigation into the motivational characteristics of successful and unsuccessful small-businessmen.
4. Cross-cultural studies of instrumental learning and coping in preschool children in Papua New Guinea and Australia.
5. The interaction of alpha and gamma motor systems during phasic stretch reflex under various conditions of stimulation.
6. An investigation of the possible effects of the abolition of fees on certain characteristics of the student population at Wollongong University College.
7. The investigation of methodological and theoretical problems involved in time judgment studies, with special emphasis on internal clocks and interpretation of time judgments in terms of the subjective speed of time.

8. Collection and further processing of data describing suicidal behaviours (principally drug overdoses) from country districts of New South Wales.
9. Collection of data describing the bisensory presentation of signals.
10. Using a foreman's injury form designed with research possibilities in mind, a comprehensive analysis of the physical factors associated with injury causing incidents has been undertaken at the Port Kembla plant of John Lysaght (Australia) Ltd. Examination of primary cause of injury, agent of injury, movement preceding the incident, place, time of day, shift and time since last break has already indicated a number of areas requiring more concentrated research. A second component of this research is comparing high accident repeaters with a matched sample of safe workers, the comparison exploring such variables as personality, visual competence, life history and work history. A third component of the research involves the detailed analysis of an observed sample of incidents which do not result in an injury.
11. A detailed comparison of job environment, work requirements and condition, and employee attitudes and personality characteristics is being made with respect to two classes of jobs, one with a high labour turnover and the other with a low. This work is directed towards making practical changes in the work situation, employee selection or training, or whatever other practically controllable variables emerge in order to reduce labour turnover.
12. Educational opportunities and disadvantages of deprived cultural groups. This research involves extensive field work in areas where there are concentrations of Aborigines and/or white children living in culturally deprived circumstances, and the research is investigating the relationship between this kind of background and the children's intellectual development. An experimental approach, in terms of a specially programmed preschool education, is also being used.
13. An initial successful attempt has been made towards correlating the personality variable of suggestibility with perceived autokinetic movement and an objective measure of the achievement motive is nearing completion.



PUBLICATIONS



DEPARTMENT OF EDUCATION

P.R. de Lacey and L.J. Taylor.

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P.R. Dasen, P.R. de Lacey, and G.N. Seagrim.

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The Psychology of Aboriginal Australians, (Sydney, 1973).

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'Divergent thinking in Aboriginal children', Australian Psychologist, 8, (1973), 42-45.

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'The question of Aboriginal intelligence: the first three years of the Bourke preschool', Medical Journal of Australia, 2, (1973). 625-630.

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## DEPARTMENT OF GEOGRAPHY

F. Beavington.

'Contamination of Soil with Zinc, Copper, Lead, and Cadmium in the Wollongong City Area', Aust. J. Soil Res. II, (1973), 27-31.

R. Robinson, and J. Shaw.

'Density Gradients and Urban Shape in the Illawarra Corridor 1954/66' published in Australian Geographical studies, 11, (1973), 211-227.

## DEPARTMENT OF HISTORY

R. Duncan.

Review of R.W. Breach and R.M. Hartwell, British Economy and Society 1870-1970, (London, 1972), in Labour History No. 25, (1973), 93-94.

J.S. Hagan.

'Review of W. Howitt, Land Labour and Gold (Sydney, 1972), in Labour History, No. 25, (1973), 90-91.

J.S. Hagan.

Review of J.D. Bolten, Protestantism and Social Reform in New South Wales 1890-1910, (Melbourne, 1972) in Labour History, No. 25, (1973),

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A.M. Healy.

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C.P. Kiernan.

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A.M. Clarke.

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L.L. Viney, A.M. Clarke and J. Lord.

'Resistance to extinction and frustration in retarded and nonretarded children', American Journal of Mental Deficiency. 48 (1973), 308-315.



## DOCTOR OF PHILOSOPHY

1966	P. Van der Werf (Mechanical Engineering)
1968	P.C. Arnold (Mechanical Engineering) R.T. Wheway (Mechanical Engineering) N.F. Kennon (Metallurgy)
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1971	Z. Herceg (Electrical Engineering) J.W. Boldeman (Physics) A.I.M. Ritchie (Physics) D.J. Clarke (Mathematics) D.J. Richardson (Mathematics) B.E. Clancy (Mathematics)
1972	K.A. Fleming (Chemistry) R. Rudzats (Chemistry)

R.E. Summons  
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## MASTER OF SCIENCE

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R. Rudzats  
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G.A. Segal  
(Physics)

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R.W. Wilcox  
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	R. Newell (Metallurgy)
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	J.R. Robson (Chemistry)
	G.L. Sefton (Chemistry)
	E.J. Clayton (Mathematics)
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	R. Schibeci (Chemistry)

#### MASTER OF ENGINEERING

1964	P. Van der Werf (Mechanical Engineering)
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MASTER OF ARTS - PASS

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MASTER OF ENGINEERING SCIENCE

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	R.J. Graham (Mechanical Engineering)
1972	R.J. Derrington (Mechanical Engineering)
	J.T. Devine (Mechanical Engineering)
	K. Forbes (Mechanical Engineering)
1973	R.J. Davey (Mechanical Engineering)





