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ADDRESS:
Science Centre,
35-43 Clarence St.,
Sydney, NSW 2000.
Telephone 29 7747. Telex 25578.

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All enquiries and correspondence concerning subscriptions to:
Australian Institute of Physics, Science Centre, 35-43 Clarence St.,
Sydney, NSW 2000. Telephone (02) 29 7747.

BRANCH SECRETARIES — ADDRESSES:
NSW Mr D. Bailey
Department of Physics,
NSW Institute of Technology,
P.O. Box 123,

ACT Dr G.A. Stewart
Department of Physics,
Royal Military College,
DUNTRON, ACT, 2600.

SA Dr K.J.W. Lynn
Navigation Group,
Defence Research Centre, Salisbury,
G.P.O. Box 2151,
ADELAIDE, SA, 5001.

VIC Dr J.D. Riley
La Trobe University,
BUNDOORA, VIC, 3083.

QLD Dr W.R. MacGillivray
School of Science,
Griffith University,
NORTH, QLD, 4111.

WA Mr A. Van Riesen
School of Physics and Geosciences,
WA Institute of Technology,
Kent Street,
BENTLEY, WA, 6102.

TAS Mr J. Boersma
Tasmanian C.A.E.,
LAUNCESTON, TAS, 7250.

Assistant Secretary — Melbourne
Miss Rosemary Durrant
National Science Centre,
Claytons Ross House,
PO Box 52,
PARKVILLE, VIC, 3052.

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views of the Australian Institute of Physics, its
Council or Committee.
President's Column

I would like to begin this column by thanking the members of the Institute for the honour given to me through my appointment; I acknowledge the trust and responsibility involved. Normally of course the election of a new AIP President is an event with great impact on the national news media. However this time it appears to have been largely obscured by other, more political, events.

The appointment of a new Executive makes it appropriate to reflect on the Institute, its history, its present state and on where it should be leading. A poor historian, I do however have some vague memories of a meeting held at the University of Melbourne to discuss the formation of the Institute. Some years later, when I agreed to join a sub-committee of the Victorian Branch, I did the right thing and also joined the AIP. While we must not become complacent, and there is much to be done yet, I have, for many years, observed the development of Australian physics and of the AIP with much satisfaction. In future 'President's Columns' I will outline some of my own views on aspects of Australian physics and will discuss various activities of the Institute. I would hope that some of these result in dialogue — by letters or even rude telephone calls to me or by letters and polite calls to the Editor.

As well as becoming more aware of the activities and future directions of our Institute it is important to note some important developments in other countries of our region. Only very recently has an autonomous New Zealand Institute of Physics been set up; its first national conference is to be held in May. I have asked Neville Fletcher, who will be attending, to express our congratulations and best wishes on this important occasion. In June the first Asia Pacific Physics Conference will be held in Singapore. A significant number of Australians will be attending and presenting papers. I expect to attend and hope that this conference will facilitate the liaison, well exhibited at the 1982 Canberra Congress, between the AIP and the several other physics institutes and societies in our region.

In concluding this column I would like to pay tribute to the wonderful contribution to the AIP made by Neville Fletcher. We thank Neville and also wish him well in his new appointment as Director of the Institute of Physical Sciences, CSIRO.

Jeff Wilson

Editorial

Despite the disclaimer in John Jenkins' article on the Cavendish Tradition, I believe that physicists are a versatile breed and can make their mark relatively easily in many related disciplines. Whether this is their exclusive prerogative I am, however, unable to say. It is on this basis that I have been including news items in "Physics Roundabout" that the purists might call engineering or biology or physiology or chemistry. Having got away with that ( — the most adverse reaction appears to have been apathy) I am beginning to wonder about politics and the humanities. It is somewhat disquieting to be told by the Chancellor of Griffith University that he doubts whether science students comprehend human values. If this is indeed so, it is not for lack of opportunity, but must surely be motivation. Is there necessarily a dichotomy between the two cultures? Is it possible to produce a healthy balance of interests in school children of all ages? Or is that first encounter with a computer, or a chemistry kit, or a building set, sufficient to separate each individual into one of two distinct branches of mankind?

The change of government has combined with the devaluation to make the economic climate even more uncertain than it has been for some time. At the time of writing, the Australian dollar does not seem to want to stay down, and it is to be hoped that the "scientific index" will also begin to rise. We should all explore any contacts we have with the new politicians in an attempt to inform and enlighten them concerning the virtues of science. Remember that any dichotomy works both ways, and try a little missionary zeal on this deprived section of mankind.

There has been some difficulty in addressing the last two issues of "The Australian Physicist". If you did not receive one or both of these, please let me know.

Jim Graham

The Australian Physicist, Vol. 20, April 1983 — Page 61
Diagnostic Testing for Success in Tertiary Physics

P.F. Logan & D.E. Bailey, The N.S.W. Institute of Technology P.O. Box 123, Broadway, N.S.W. 2007

INTRODUCTION

When the authors presented their poster at the A.I.P. National Congress in Canberra (1982), they were more than surprised at the extent of the interest shown by physicists from all over Australia. The initial idea was to present a poster of the work and to seek ideas, criticisms and suggestions which would help in the design of the continuation of the work in 1983. We expected a modest, polite interest but the response was more widespread and at a greater depth than expected, and reflected the concern of a great number of physicists that the situation in Physics Education is not what it should be. This paper is presented here in an effort to publicise even more widely the work being done at N.S.W.I.T. so that a wider discussion can occur and hopefully our diagnostic process can be refined. Diagnostic work by itself is important but the appropriate remedial process is also important and hopefully some assistance will also be forthcoming with this aspect of the program.

STUDENT BACKGROUND AND PERFORMANCE

Student entry at the N.S.W.I.T.

Concern within the Department, at the performance of the students attempting first year studies, led to the development of the testing program. The diagnostic tests were prepared and administered to the Applied Science students, entering the Physics I course, before the first lecture of the course. This course was chosen because it is the one taken by our own (Applied Physics) students and the Higher School Certificate (H.S.C.) aggregate required to enter that course was significantly lower than for other courses offered by the Department. (The H.S.C. aggregate is obtained as a sum of t-scores, with a maximum possible total of 300, the Geology cut off is 270, whereas for all the other Physical Science students it is 240.) As a result of this, the Applied Science students find the Physics I course a difficult one. The Engineering and Life Science students with higher H.S.C. aggregates have a significantly higher pass rate.

Because of the applied nature of the course and with two semesters' work experience included, a small number of high aggregate students also enrol. This results in a large range of abilities within the Physics class. Furthermore, the intake has a large proportion of students from ethnic groups. For the 1982 intake, students came from a diversity of backgrounds — Eastern and Western Europe, the Indian Subcontinent, South East Asia, Pacific Islands and South America. Hence the outstanding feature of the student intake is its diversity both in academic achievement and cultural heritage.

Results of the Cohort Study

Commencing in 1976 the total student intake for that year at the N.S.W. Institute of Technology, was followed through till 1980. This study was titled the Autumn Cohort Study and revealed some disturbing statistics. The results indicated that an extremely large percentage of the students who entered the courses offered by the N.S.W. Institute of Technology did not complete their studies. Of the 1976 intake of students, for the Faculty of Science, 23% overall graduated, 28% were still continuing their studies in Autumn 1980 and 51% had discontinued (Autumn Cohort Study — N.S.W.I.T.). The figures for the School of Physics & Materials were somewhat different in that only 3% had graduated, 35% were still in the course and 62% had discontinued their studies.

Department Concern

Whilst accepting that some students discontinue, or fail, for reasons outside our cognisance, and due to reasons beyond our control, the fact is that our experience in teaching these students leads us to conclude that there are some identifiable common factors. For example continued monitoring has indicated that no previous experience in Physics or Chemistry at H.S.C. level combined with 2Unit Mathematics and a low aggregate are a fatal combination.

If these failing students were disinterested or unmotivated students the problem could be dismissed as another case of “well what do you expect?” However, this is not so. Many of the students desperately wish to pass and some only succeed on the third attempt.

DIAGNOSTIC TESTING

In the Applied Physics Department at N.S.W.I.T., there were the occasional questionnaires given to students on completion of a course to determine their attitude to different aspects of the course. Furthermore there were studies on the correlation of HSC aggregate and performance in the course. It was found that the HSC aggregate correlates well with performance at the Institute. This has led to a maxim in the department that a HSC aggregate of over 300 is required to do well in the course; however, there has never been a comprehensive longitudinal study.

It was with this background, in late 1981, that we began our research project described in this paper. The aim of the project is to provide a better learning environment for physics students at the Institute. The project will involve a study of the performance of physics students throughout their course at the Institute. Furthermore, diagnostic tests will be used to see if there are good predictors of a student's performance. This is not to label the students as “pass” or “fail” at an early stage in their course, but rather to provide the “weaker” students with appropriate remedial material or to provide alternative pathways for student progressions. The Physics I course is broken into smaller groups of about 16 students for laboratory classes, hence it would be possible to have groupings according to similar abilities, to provide a more conducive learning environment and to provide remedial activities for these groups.

What we are seeking is a diagnostic test which would identify more readily and reliably the students at risk
and the reasons for their lack of success. If this can be done then perhaps we can also provide the right remedial climate so that those students can overcome their handicaps and successfully complete their courses.

From our past experience with similar students, we have developed our own ideas as to why these students fail. These can be identified as:

1. Lack of background in the subject.
   i.e. Physics readiness.
2. Lack of vocabulary and language comprehension.
3. Lack of mathematical skills needed for the course.
4. An unreadiness for formal presentation of syllabus material. In Piagetian terms they are still substantially at the concrete stage of development.

There is no prerequisite knowledge of Physics required for entry to the Applied Physics Degree course. The course starts at a low level to take this into account. The implicit assumption behind this approach is that the students possess enough familiarity with English and general scientific language and that we are only presenting new material which builds upon the material already covered. Each year lecturers are realising more and more that this is not so as the classes are found to contain an increasing number of students with “English as a second language” problems. There is also the other side of the language problem with some lecturers being of foreign extraction, and others having accents varying from full Queen's English through to drawled Australian slanguage. Compared to these problems, the traditional problems of lecturers talking to a blackboard pale into insignificance.

The testing of the students’ mathematical skills is already being carried out by the Mathematics Department. Whether a correlation exists has not yet been determined.

The last factor considered as worthy of examination is the concrete-formal transition. If students are entering a formal course situation whilst still unable to think at that level then we are obviously going to observe problems. We think that this is present among a number of our students and that we should attempt to identify the Piagetian level of our students and if possible involve the students in any remedial program which will increase their ability to handle abstract concepts.

IMPLEMENTATION

To examine all these factors so that some indicators could be determined the following programme was developed.

General Survey

A student questionnaire was prepared and was administered to the students prior to any contact with the Physics course. Not only did it ask about the student's HSC aggregate, marks in Physics, Maths and English but also their initial attitude towards Physics, why they are doing Physics, what languages they spoke and their ancestry. The composite student profile and the success in Physics 1 was presented at the AIP Congress and is reproduced in Table 1.

The results in Table 1 are largely what one would expect. Students with Physics and Chemistry to H.S.C. did very well, whereas students without Physics did poorly. Students with H.S.C. aggregate above 300 also did well, whereas students with aggregates between 270-300 did only marginally better than students with aggregates 240-270. Perhaps the surprising statistic,

<table>
<thead>
<tr>
<th>TABLE 1. INCOMING STUDENT PROFILE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physics 1 (Applied Science students)</strong></td>
</tr>
<tr>
<td>Number of students = 150</td>
</tr>
<tr>
<td>Percentage Directly from H.S.C. = 81%</td>
</tr>
<tr>
<td><strong>Physics Background</strong></td>
</tr>
<tr>
<td>Students with Physics and Chemistry to H.S.C. = 51%</td>
</tr>
<tr>
<td>Students with Multistrand = 12%</td>
</tr>
<tr>
<td>Students with only Physics = 6%</td>
</tr>
<tr>
<td>Students with only Chemistry = 12%</td>
</tr>
<tr>
<td>Students with neither Physics nor Chemistry = 19%</td>
</tr>
<tr>
<td><strong>Ancestry</strong></td>
</tr>
<tr>
<td>Students claiming non-British ancestry = 51%</td>
</tr>
<tr>
<td>Students born overseas = 30%</td>
</tr>
<tr>
<td><strong>H.S.C. Aggregate</strong></td>
</tr>
<tr>
<td>Students with H.S.C. aggregate above 350 = 10%</td>
</tr>
<tr>
<td>Students with H.S.C. aggregate between 300-350 = 16%</td>
</tr>
<tr>
<td>Students with H.S.C. aggregate 270-300 = 20%</td>
</tr>
<tr>
<td>Students with H.S.C. aggregate 240-270 = 54%</td>
</tr>
<tr>
<td><strong>Success in Physics</strong></td>
</tr>
<tr>
<td>68%</td>
</tr>
<tr>
<td>68%</td>
</tr>
</tbody>
</table>

considering the language problem mentioned previously, was how well students born overseas did.

Physics Readiness Test

The Physics Readiness test included some elementary numerical substitution and some questions on basic Physics knowledge, ranging from vectors, energy, S.H.M., Units and Powers of Ten through to conversions from cubic metres to litres. As well as this, a comprehensive test of a physical situation was included. The overall results of this test were that, whilst a general correlation existed between performance on the test and final examination performance by the students, the range of results was so very wide at all levels that no reliable identification of “students at risk” could be made.

Maths Readiness Test

A Maths Readiness Test was not prepared because the Maths Department also gave the students a test and we had hoped to use the results from that. However the Maths Department does not keep records and hence we do not have those results. We will prepare our own Maths test for next year.

Piagetian Development Test

The usual Piagetian test requires a clinical (1 to 1) administration. However a written test was designed based on other written Piagetian tests (Sheenan (1970), d’Avila (1977), Lawson (1976)). The concepts tested were:— perspective, horizontality, conservation (mass and volume), probability, ratio and proportion, equilibrium, exclusion of variables, and logic. There were three questions on each concept and students were asked not only to record their answer but also to explain the reason for their answer. The questions are presented in a cartoon format. The results for the Physics 1 class are given in Table 2.

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TABLE 2. RESULTS OF DIAGNOSTIC TEST

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Percentage Completely Correct (144 students)</th>
</tr>
</thead>
<tbody>
<tr>
<td>calculation</td>
<td>34%</td>
</tr>
<tr>
<td>perspective</td>
<td>88%</td>
</tr>
<tr>
<td>horizontality</td>
<td>92%</td>
</tr>
<tr>
<td>conservation</td>
<td>64%</td>
</tr>
<tr>
<td>probability</td>
<td>49%</td>
</tr>
<tr>
<td>ratio and proportion</td>
<td>71%</td>
</tr>
<tr>
<td>equilibrium</td>
<td>51%</td>
</tr>
<tr>
<td>exclusion of variables</td>
<td>59%</td>
</tr>
<tr>
<td>logic</td>
<td>11%</td>
</tr>
<tr>
<td>All Piagetian concepts</td>
<td>2%</td>
</tr>
</tbody>
</table>

At the AIP Congress, we learned that the Physics Department at Murdoch University had administered similar tests. They found their results very interesting, but were unsure what action could be taken based on this information. We hope to investigate the implications of the Piagetian test results. One of the advantages of the Piagetian Test, over the I.Q. type tests that are often quoted, is that deficient areas can be isolated and remedial activities designed and administered. Furthermore it makes the lecturers aware of the level of conceptual development they can expect in their classes, and the implications of that in adopting a formal operanting lecturing approach.

Language Test

Ms. Powe in her paper at the AIP Congress spoke of the problem of language in the classroom. The average student does not understand many of the words used by lecturers, not just the physics words but the regular "English" words. A study in Papua New Guinea, found that the majority of university students did not know the meaning of "as a consequence", "includes", "contradictory", "essential", "definitely", "not all", "only" and "some". Gardner (1975) reported a scan of 27 Science text and reference books, containing a total of 32.5 million words. The study found over 200 logical connectives which were frequently used. He then chose 25 of them and designed tests comprising sentence completion and gap filling items and administered them to high school students. He found that several were not understood by 50% of the 4th Form students in at least one test item.

The important thing is that lecturers should be aware of the comprehension ability of their students and use appropriate language. This needs to be taken into account in the choice of a suitable textbook.

MULTIPATH?

Over the years innovations have been introduced into the course to take into account some of the learning difficulties experienced by Physics students. These include the tutorial booklets and the Junior Physics Centre (J.P.C.). The lecture courses are supported by a comprehensive set of tutorial booklets for each course. In each booklet there is a statement of the syllabus details for that topic, a brief statement of the theory covered in the topic, worked examples and then graded examples which have answers but no worked solutions and reference to the relevant sections in the text and reference books. At the back of the booklet there are examples of past exam questions specifically on that topic area so that the students can see the level of difficulty and the standard expected by the end of the course. These booklets are used in conjunction with the JPC which is a room set aside for student use as a reference centre where the students can work on their own study program or get help from an academic with any of the Junior Physics tutorial problems, with the laboratory work or the theory covered in the lecture course. The JPC is manned for about 20 hours a week both during the day, and in the evening for the benefit of part-time students.

Faced with the extreme diversity in the student intake, the Applied Physics Department at NSWIT is about to try another approach. Rather than trying to develop a single method of presentation that will suit every single student, regardless of personality, temperament, academic and cultural background, the Department is investigating the feasibility of introducing alternative pathways in the physics course. Logan came across alternative pathways at the University of Irvine where the Physics course was offered by both traditional lectures and computer assisted instruction. In fact, there are two paths available at NSWIT at present, some students prefer to simply work through the tutorial booklets along with the textbook, rather than attending lectures. However we would like, in the future, to provide a number of other alternative paths.

At the A.I.P. Congress in another poster the different paths available for the teaching of Physics were listed, these are shown in Table 3. Some of the inherent problems encountered along these paths were illustrated in the accompanying poster.

TABLE 3. INSTRUCTIONAL STRATEGIES AVAILABLE FOR TEACHING PHYSICS

i) Lectures:— at a formal or concrete operational level
ii) Tutorials:— traditional tutorials or skills sessions
iii) Laboratory:— scheduled laboratories, open laboratories, and project experiments
iv) Textbook:— traditional text or programmed text
v) Audio-visual Aids:— sound cassette/booklet packages, tape/slide sequences and video-cassettes
vi) Computer Assisted Instruction:— problem solving programs, simulations, interactive proofs, alternative universes and games

CONCLUSION

As stated at the outset, this project is in its infancy and we are greatly encouraged by the discussions we had at the A.I.P. Congress. We would like to hear from other Physics Departments who are doing similar diagnostic testing. Considering it is the first year of the project we are greatly encouraged by the results to date. We seem to have made fewer mistakes than we could have, and much of our data is proving invaluable in discussing Faculty Policies.

We will revise all our tests for the 1983 intake and hope to have a Language and Mathes Readiness test available as well. The Applied Chemistry Department is very interested as well. The Applied Chemistry Department is very interested in joining us in the project since they experience many similar problems. It is also intended that the 1982 intake will be followed through their course.

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As already stated, our concern is not to produce diagnostic tests for their own sake, or even studies on student's conceptual development but rather to investigate the implications of our findings for creating a better learning environment for Physics Students. We hope in the near future to develop additional material (that could be considered as remedial but is also far more general) to suit the different temperaments, cultural and academic backgrounds found in our Physics classes.

In conclusion, we submit the questionnaire in Table 6., as the ideal follow-up questionnaire for any physics course or even this article. (We were sent this questionnaire from U.N.E. via P.N.G. but it seems the name of the author has been lost in the mists of antiquity.)

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Autumn Cohort Study, (1980), Internal Publication, N.S.W. INSTITUTE OF TECHNOLOGY.
d'Avila, E.A. (1977), Private Communication. (Oakland: California)
Sheenan, D.J., (1970), "The Effectiveness of Concrete and Formal Instructional Procedures with Concrete and Formal Students.", Albany: SUNY, Uni Microfilm, 70-25,479

THE AUTHORS
David Bailey is a W.A. graduate who joined the fledgling Institute of Technology in 1967 (via the University of N.S.W.) and has remained there except for study leave at Harwell and Bristol University in 1974/1975 and in 1981 at A.W.A. Microelectronics. His interests are mainly in Physics Education, Applications of Micro Computers in Teaching, Crystallography and Microelectronics. He is presently Secretary of the N.S.W. Branch of the A.I.P. and runs classes in electronics for Gifted & Talented Children from ages 9 - 15 years.

Peter Logan came to the Institute in 1981 from Papua New Guinea having spent ten years teaching Physics at the University of Technology. His special interests are in Cross-Cultural physics Education and Appropriate Technology.

Inventors: Increased funds available

Increased funds are now available to inventors through the Assistance to Inventors Scheme.

The Scheme, which is administered by the Department of Science and Technology, provides assistance to inventors for the development of new products and processes.

Grants of up to $10,000 are available to private individuals for developing and testing invention prototypes.

Panels in each State assess inventions according to their novelty and technical and commercial potential. Based on this investigation, the Central Panel makes recommendations to the Minister for Science and Technology regarding the level of assistance to be provided.

In addition to financial support, the Scheme provides advice to inventors on technical, industrial and commercial matters relating to the development and marketing of inventions.

The increase in funds to the Scheme follows the recommendations of the Kirby Committee, which considered it to be a valuable means of encouraging innovation in Australia.

Inventors can obtain further information about the Scheme from the regional office of the Department of Science and Technology in each State capital, an Inventors Grant has been awarded to Canberra inventor Mr. K. Flynn, who has been working on a system to increase the radar visibility of inflatable life rafts.

The invention promises an economic solution to a serious maritime survival and rescue problem. Its development and trials should prove inexpensive, and its market prospects are excellent.

Mr Flynn’s invention consists of building radar reflectors into the buoyancy tanks of inflatable life rafts. The reflectors automatically erect when the life raft is inflated; their dimensions allow for a large reflecting area with prospects of strong radar responses. They do not take up space within the raft and do not require operation; there are no loose parts which might be lost overboard or cause injury to survivors, and the reflectors are protected from the effects of the sea.

Dr R.W. Piddington is the Queensland inventor of a unique hearing protection device, and also received a grant.

Dr Piddington estimates that at least one tenth of all jobs require hearing protection, and that his invention will have very large markets in Australia and throughout the world.

The invention is a mechanical automatic volume control, excluding loud noises which exceed accepted safety levels, while allowing the wearer to hear softer sounds such as speech.

Being a mechanical, not an electronic device, the invention needs neither a power supply nor maintenance, and it will be cheap to manufacture.
Prize-Winning Posters At The Fifth National Physics Congress

S.J. Campbell, Department of Solid State Physics, Research School of Physical Sciences, Australian National University, Canberra, A.C.T. 2600

I first encountered posters as a form of presentation of conference papers at the inaugural AIP Solid State Physics Meeting in 1977. The use of display boards, measuring typically 1.5 m width by 1.2 m height, was new to most people at that time and, apart from the observation that their introduction would restrict the opportunities for new speakers, particularly research students, to gain experience from presenting short talks (~15 min), opinion was generally in favour of this new form of presentation. Subsequent developments have confirmed this initial assessment and poster sessions are now an established and integral part of meetings and conferences at all levels.

Several articles have been published recently on the topic of poster presentations. The paper by Lung and Anderson (1981) gives a useful introduction and background to the development of poster papers in lieu of oral papers and also provides detailed information about the preparation of posters. Further helpful comments about the merits of this new conference medium have been reported by Bailey (1982).

As the organising committee of the Congress had decided that only invited participants should give oral presentations, all contributed papers were presented as poster papers. There were 42 posters presented; they covered all aspects of physics and were separated into three sessions under the headings: Atmospheric — Solid State; Energy; Education Quantum-General.

The poster boards were made from sheets of canet e which are available with the convenient dimensions of 1.8 m by 1.0 m. These proved large enough for most authors. Canet e also has the advantage that it is a relatively soft material and pins can be inserted easily.

The posters in each category were on display all day, 9am — 6pm, with a one hour period being set aside immediately after lunch for the formal poster sessions. All authors were expected to be in attendance during this hour and, with no activities in parallel, the poster sessions proved to be lively, animated occasions. I think the important point here is that posters warrant an independent session on their own during the core hours, say 9am — 6pm, of the conference programme. Presenters of posters find generally that a continuous cross-examination by a body of conference delegates for one or two hours is much more exacting and demanding than a fifteen minute talk with its necessarily short and often perfunctory discussion. By comparison, poster sessions at the seven national meetings or conferences which I have attended in Australia since 1977 have either been held continuously through the day as an adjunct to the main oral sessions, or been held informally in the evening.

A novel feature introduced was the award of prizes to the authors of the three best posters in each session. Authors had been advised of this in earlier correspondence and, although it is difficult to appraise whether this triggered the competitive edge in authors or not, the standard of posters was, as noted by Collins (1982) in his review of the Congress, strikingly high. The members of the judging panel, Professor W.A. Runciman and Dr. R.W. Crompton, chairman and deputy chairman of the organising committee respectively and Mr. I.B. McRae and Mr. R.B. Turkentine of the Department of Solid State Physics, ANU, who constructed the prizes, were at pains to point out that the uniformly high standard made their task a very difficult one. The panel members were asked to judge posters on the basis of three aspects: (i) presentation, especially the visual impact and clarity of the display; (ii) the content and scope of the poster and (iii) the ability of the poster to impart understanding of the work to the reader.

The approaches taken by authors were quite varied, ranging from the professional finish provided by the multi-coloured, high quality display of Mr. S.A. Fysh of BHP Central Research Laboratories, to the informal, but very effective, "Prudence Pure" correspondence column devised by Dr. Neil B. Manson of ANU. In the latter poster, the worried and concerned correspondent, whose burning desire in life was to learn about "Optical Holeburning in Solids", was enlightened readily on this topic by the lucid replies from Prudence. This inventive approach by Neil Manson is likely to stimulate others to find equally penetrative ways of presenting poster material.

It was clear that certain departments have considerable expertise in poster presentations with the four posters of the Plasma Research Laboratory, ANU, and the three posters by Bailey and Logan of NSW Institute of Technology on Physics Education all being of a consistently high standard. The latter workers added to their posterior display by demonstrations of the effective ways in which a microcomputer can be used to enhance learning processes. Hillery and Smith, again of NSW Institute of Technology, also combined their display with experiment. They used a stereoscope to demonstrate how established techniques of stereoscopic aerial photography have been adapted to obtain three dimensional surface features from SEM microphotographs of, in their case, solar surfaces.

The Prize-Winning Posters

<table>
<thead>
<tr>
<th>Session</th>
<th>Winners</th>
</tr>
</thead>
</table>
| Atmospheric — Solid State | 1. C.A. McCammon and D.C. Price  
"The Mossbauer Effect in (Fe,Cos) Solid Solutions" |
| | 2. Neil B. Manson  
"Optical Holeburning in Solids" |
| | 3. S.A. Fysh  
"The Mossbauer Lineshape in the Presence of a Range of Nuclear Environments" |

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required to produce an outstanding poster and, to capitalise on this, the presenters of the posters were asked if they would prepare short reports on them. They were asked to concentrate mainly on the design and format of the posters and to indicate the time and effort involved in their construction.

**Poster: The Mössbauer Effect in (Fe,Co)S**

**Authors:** C.A. McCammon and D.C. Price

Presented by: Catherine A. McCammon, Research School of Earth Sciences, ANU.

In designing this poster there were three objectives that I wanted to fulfil. Firstly, I wanted to attract those people who were interested in discovering more about my work beyond the title and abstract of the paper. Secondly, I wanted to educate those interested in my work in a manner which was quick and painless, not losing any prospective participant to boredom or eyestrain. Thirdly, I wanted to provide a platform for discussion by presenting the work in a slightly provocative manner, inviting comment and perhaps controversy on the scientific work.

To achieve these objectives, I set out several guidelines to follow in constructing the poster.

1. **Present the science at a level accessible to a large number of participants, for example (in my case) those who were familiar with the Mössbauer effect, but knew nothing about sulphides. Omit unnecessary detail which would cloud the overall picture being conveyed.**

2. **Let pictures tell the story of the work. The science of my poster was contained primarily in the graphs and illustrations, with the captions providing only pointers of what to notice. A few detailed boxes of text scattered throughout the poster provided additional information for those interested, but were not essential to understanding the work.**

3. **Use colour intelligently. Colour was useful in my poster for highlighting the difference between...**

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Table 1. The title and authors of the prize-winning posters.

<table>
<thead>
<tr>
<th>Energy</th>
<th>Education — Quantum — General</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Solar Saline Pond Research in Australia”</td>
<td>“Development of a Cryogenic Gravity Gradiometer for Geophysical Exploration”</td>
</tr>
<tr>
<td>2. A.D. Cheetham and G.R. Hogg</td>
<td>2. P. Hariharan, B.F. Oreb and N. Brown</td>
</tr>
<tr>
<td>“X-Ray Diagnostics on the LT-4 Tokamak”</td>
<td>“A Digital System for Real-Time Holographic Stress Analysis”</td>
</tr>
<tr>
<td>“Copper-Based Photovoltaic Cells”</td>
<td>“Multipath Teaching”</td>
</tr>
</tbody>
</table>

Figure 1: “The Mössbauer Effect in (Fe,Co)S Solid Solutions” by C. McCammon and D. Price (first prize, session Atmospheric — Solid State).

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spectra at different temperatures, or contrasting crystal structures at various pressures. A sparing use of colour adds interest and excitement to a poster, but overuse probably obscures the overall picture being conveyed.

4) Ensure that the poster is legible from several feet away. This not only prevents eyestrain, but increases the number of people able to view the poster at once.

Construction of my poster took place in short sessions over a period of about six weeks, allowing plenty of time for ideas to develop. In this way it also served as a creative outlet for frustrations generated in the experimental laboratory.

The remaining two posters are not suitable for reproduction here.

**Poster: Solar Saline Pond Research in Australia.**

**Author:** P. Golding.

Presented by: Peter Golding, Department of Mech. and Industrial Eng., University of Melbourne.

The successful completion of the above poster followed preparation and planning over a month prior to presentation. The overall aim of the poster was to provide, in an interesting, clear and imaginative way, a description of the major research projects on solar saline ponds which have been undertaken in Australia.

A precis was constructed of the salient aims, features and experience gained in Australian solar saline pond projects. This was then illustrated with clear diagrams and appropriate photographs. The layout of the poster was experimented with and numerous ideas discussed with friends.

The final layout was produced and the artwork carefully undertaken on card which was poster-size but divided into manageable sections for handling and travel. All material was assembled in the week prior to attending the Conference. When constructing the poster the viewer was always kept in mind — what would he or she see, read and learn about solar pond research in Australia by looking at the poster? A handout paper was also written, for viewers to take away for further information and sources on the subject.

Figure 2 shows the presentation of the award for this paper.

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Presented by: Frank J. van Kann, Physics Department, University of Western Australia.

This poster was designed to function at three distinct levels. On the first level, the title and introduction were aimed at the virtual layman in the field, serving merely to outline the purpose of the research.

Should such a person express further interest in the work, then the poster begins to function at its second level. For this, it is essential that the poster be attended. The figures and diagrams in the central region of the presentation were designed, and arranged just as they would be in support of a short research seminar on the work. This could be delivered at any time to a self-selecting audience, with the additional benefits of immediate feedback and even participation. At this level, aims of the research and the details of the principle of operation and design of the apparatus could be discussed at any desired depth.

This then leads to the third level of the poster, where the most recent theoretical analyses and latest experimental results were outlined. It should be possible for an expert in the field to go directly to this level, unassisted.

However, the main thrust of the poster was at the intermediate level. Since it was essential for it to be attended to function at this level, it required the greatest effort here — but it also yielded the greatest rewards.

**Concluding Remarks**

The quality of posters presented at the AIP Fifth National Physics Congress was extremely high. The poster sessions were well attended with lively discussions developing. This may or may not be linked with the introduction of prizes for the best posters but, regardless of such a link, the assessment of posters by an independent panel of judges appears to be a useful addition to poster sessions. Besides providing a stimulus and challenge for improved quality in poster presentations we also benefit from learning about the skills of the winners, in this case Ms. C. McCammon, Dr. P. Golding and Dr. F.J. van Kann, as presented in their reports above.

On the basis of the experience gained from the poster sessions at the Congress, the following suggestions and remarks, in approximate order of importance, can be made to organisers of future poster sessions.

1. Afford proper status to the authors of contributed poster papers by holding the poster session free of competition from parallel sessions of contributed oral papers.
2. Allocate a time during the core period of the conference programme when authors must attend their posters.
3. Size of poster boards: the area of the present boards, 1.8 m by 1.0 m, proved to be large enough for most authors.
4. The poster hall should be large enough to allow room for discussion groups to form around poster boards while allowing room for the body of conference delegates to manœuvre.
5. Ideally the poster hall should be close to the tea and coffee facilities as posters can then be viewed informally during refreshment breaks. Tables and chairs are also useful in the poster hall and basic aids such as pins, paper, scissors and tape should also be provided.

This article stems from an initial suggestion by Dr. R.W. Crompton and I wish to thank him and Professor

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**Figure 2:** Golding receiving his award from Professor Runciman.

**Poster:** Development of a Cryogenic Gravity Radiometer for Geophysical Exploration.

**Authors:** M.J. Buckingham, C. Edwards and F.J. van Kann
Comments on "Applied Physics"

By A W Pryor, Visiting Fellow, Macquarie University and CSIRO Division of Mineral Physics.

It is now difficult, almost to the point of impossibility, for a Government Research Laboratory or a University Department to engage usefully in self-guided research in Applied Physics.

By "Applied Physics" I mean the invention or development of devices, based on physics of at least moderate sophistication, for which one can foresee a profitable sale in the near term — say within 10 to 20 years. By "self-guided" I mean that the research program is initiated by the researcher and carried out at arm's length from prospective manufacturers. By "engage usefully" I mean that the cost of the developmental effort should represent a reasonable deployment of governmental resources.

Note also that I say "difficult". One can point to Governmental Laboratories and to University Departments who currently achieve some success in this field, but only minor and getting harder all the time. Note also that I say "now", because the usual justification for research in more-or-less applied physics is based on historical example, going back even to Faraday ("What use is a new-born baby?") or at least to the transistors and lasers in the 1950's. The world is not like that any more. The balance of Science and Technology is changing. Before, shall we say, 1870, Technology owed almost nothing to Science. Between 1870 and, shall we say, 1960, Science was the senior partner in the firm Science and Technology Ltd., which was in business providing useful or destructive artefacts to suffering humanity. Science, in this period, blazed the trail, pioneering the Technological marvels which, a decade or two later, the engineers developed and sold.

But since c.1960 Technology has out-voted the Science partner in the firm and reasserted its historic independence. In many fields (semi-conductor manufacture and circuitry, computers and automation, aircraft design, communications, pharmaceuticals, plastics, etc.) the best current technology appears to be far more advanced than current research in our Universities and Establishments. Technology no longer expects to make much profit out of anything currently reported in the leading Physics Journals. Mature modern Technology can look after itself. There is no place for the Physicists from the Universities and Research Establishments who nurtured the infant prodigy. Either they are employees, within the Technological world — not at the frontier and certainly not at arm's length — or they are nothing. (Nothing, that is, but scholars in a great subject. But no longer public miracle-workers in the mould of Oppenheimer, or even Oliphant). Physics is a subject, not a profession. It is similar, in this regard, to Mathematics, and may be contrasted with Medicine or Education, which are professions, but not subjects.

CSIRO and AAEC both have Applied Physics Divisions. CSIRO has, in addition, Divisions of Mineral Physics and Chemical Physics. In these Divisions the physicists are challenged (though the challenge is not always taken up) to invent something useful; to get the development funded, at least partly, by extra-mural grants; and to see it through to manufacture and installation. In a few cases they have achieved just that, but one can only say to one's lucky colleagues comfortably engaged in publishing papers in some long-studied speciality, and heeding towards an F.A.A., or at least S.P.R.S., just you try it! It's hard to look good as an Applied Physicist and getting harder all the time. The very concept of an Applied Physics group, dreaming up problems within the scope of its expertise and trying to involve the outside world in these self-generated schemes, is becoming unworkable. The current generation of Applied Physicists is in near-despair at meeting the exhortation of management: Go and invent something patentable and profitable. Have you no imagination?

What is to be done? I'll not assume the task of reorganizing Australian science but I suggest a framework. Envisage an Institute employing nearly all the active professional staff in the area. It operates central laboratories, but at least two-thirds of its laboratories are in various industrial locations giving tactical advice in that industry. Staff would transfer around the industrial sites and the central strategic-research laboratory at least once a decade and would be in close liaison at all times. Control of finances would be at least half in the hands of the industries which participate.

"How is such a structure to be established?" you ask.
How should I know? But we have any number of people who think of themselves as Scientific Administrators. Go and invent a workable organization, I say to them. Have you no imagination?

The Australian Physicist, Vol. 20, April 1983 — Page 69
Courtney Mohr — Some Reflections On A Life In Physics

Alistair Carr — Gippsland Institute of Advanced Education, Churchill, Vic 3842
Peter Robertson — Australian Journal of Physics, CSIRO, E.Melb, Vic 3002.

It is now just over 50 years since Courtney Mohr's first paper appeared in the Proc. Roy. Soc., a study of the collisions of electrons with atoms. Over the years this interest in collision problems has continued, his most recent work being a series of papers analysing the angular distributions in heavy ion elastic and inelastic collisions and transfer reactions.

Mohr's co-author on his first paper was Harrie Massey. The two had teamed up as soon as Mohr arrived as an 1851 Exhibition Scholar at the Cavendish Laboratory in 1930. Mohr and Massey had already been together as students of Thomas Laby, the Professor of Natural Philosophy at the University of Melbourne. In fact theirs had been something of a bumper year as the number of postgraduate students in physics had never been more than one. Upon completion of their Master's degrees Mohr and Massey joined the growing band of young Australian physicists who went on to take their doctorates at Cambridge. During this period between the wars little thought was given to going elsewhere, and so it is not surprising that the Cavendish came to play such a large part in shaping the traditions in Australian physics.

Mohr has very fond memories of these Cavendish years. "There were only about 40 staff and students, and most of them were from Britain or the Dominions. In those days it was a very happy band, all very informal and personal in the contacts, and with a wonderful atmosphere." Whereas Mohr's interests in later years centred on theoretical physics, most of his time at the Cavendish was devoted to experimental work on subjects such as electron scattering in gases and nuclear α-particle scattering. "There was one large room called the Drawing Office, almost as large as a lacrosse area, and people were working there with apparatus which didn't do much more than fill an ordinary dining table. It was fairly compact equipment and fairly easy to work with. Physics was in that sense relatively simple at that stage."

Rutherford provided the inspiration and leadership to the Laboratory and Mohr remembers he would frequently stop by to give encouragement and support. But it was for Rutherford's right-hand man James Chadwick that Mohr developed a special admiration, possibly reflecting a certain affinity between their characters. "In some ways I thought he had an even better grasp than Rutherford of some of the details of everyone's work. Chadwick was a very good all-rounder. He was a very kind person, very much like Rutherford in that respect. Rutherford was a booming, outward type, whereas Chadwick was a much more restrained and shy person."

Cambridge in the early thirties was an outstanding centre for physics with men of the calibre of Blackett, Kapitza, Mott, Fowler and Dirac. It was, however, Harrie Massey who more than any other shaped Mohr's development as a physicist. They had digs close to the Cavendish and would spend long hours together 'wielding the slide rule.' Mohr recalls with characteristic modesty: "Massey was a much more brilliant person than I, and he really had a very great influence on what I learnt of theoretical physics. He taught me a lot, but I don't think I taught him very much!"

After six years in England, Mohr took up a position in 1936 as lecturer in physics at Cape Town University. The change from his life of full-time research at the Cavendish could hardly have been more abrupt. Faced with the task of lecturing and demonstrating to all physics classes from first to fourth year, often numbering more than 200 students, and isolated from the European mainstream of developments in atomic and nuclear physics, Mohr's research was forced into the background. It was not until the war years that he had the opportunity to start a new line of research, this time the study of cosmic ray bursts and showers.

Not all this time in South Africa was devoted to the pursuit of physics. Mohr had always felt strongly about the responsibility of scientists to try and bridge the widening gap between science and the rest of society. This social awareness led him for a time into teaching elementary night school classes for the largely illiterate black people in Cape Town. Mohr was also active in the Association of Scientific Workers of Southern Africa, a group he and the zoologist Harold Sandon founded with the broad aim of putting forward the scientists' point of view on science-related issues affecting society. This Association was modelled along the lines of the British movement started before the war in Cambridge by the brilliant J.D. Bernal.

During the thirties Mohr himself had played a leading part in the movement of radical and socialist thinkers in England who had perceived very early the threat to world peace from the rise of Fascism. Together with Nora Wooster, he formed the Cambridge Scientists' Anti-War Group which attempted to make people more
aware of the shadow of war looming in Europe by holding a series of public meetings and discussion groups and by disseminating printed material. “We tried to get people to think more about the possibility of war and what effects scientific knowledge would have in the development of war technology. One increasingly became pressured to take some stand on these important issues; in particular a feeling that one had to accept some responsibility for the sort of work that one was doing and to explain to people the effects of these developments”.

This movement by Cambridge academics during the thirties was the intellectual and organizational ancestor of the various peace and disarmament groups that arose during the years after the war. In 1947 Mohr, with his wife Christine and three young sons, returned to Australia to take up the position of Senior Lecturer in Physics at the University of Melbourne. Two years later he was appointed Associate Professor of Theoretical Physics with the duties of lecturing to second, third, and fourth year classes and supervising a small theory group. “There really wasn’t much theoretical physics in Australia in those days. It was not until the 1950’s that other theory chairs were founded in Sydney, Adelaide, and, more importantly, we were all fairly isolated and of course air travel hardly existed. Perth, Brisbane and Hobart were particularly isolated. We didn’t hear much except by third-hand what was going on there. And they didn’t hear too much about what we were doing either!” Once again Mohr began producing a steady flow of research papers on subjects such as electron and positron scattering and nuclear collision theory. “As in most parts of the world, the emphasis in Australia was on the expansion of universities, and on the expansion of research generally. The balance between research and teaching loads became more reasonable. Compared with Cape Town at the time when I left, Melbourne was like Paradise.”

Research in Melbourne during the 1950’s and 60’s became increasingly concentrated on nuclear physics. “It has been a prestige area in recent decades, being regarded as one of the fundamental areas. Melbourne and the A.N.U. were the two main centres that mustered the time, money and expertise to enter this work. Over the last few years we have become more diversified in Melbourne. At the same time we are spending more of our time on practical applications of nuclear physics, particularly the techniques of nuclear physics, in all sorts of areas like solid-state physics. Many areas of atomic physics now use techniques of the same type once used in nuclear physics. The sorts of interconnections between these techniques in physics and high-technology industry are also becoming more and more developed, so that sense physics is becoming more and more useful to the ordinary person.”

In 1971 Mohr retired from the University of Melbourne as Emeritus Professor of Theoretical Physics. However, retirement did not spell the end of his research in physics, nor did it diminish his strong belief that scientists must become actively involved in those social and political issues for which they possess special expertise. Of central importance is the continuing threat to mankind of nuclear warfare.

In 1945 when the first atomic bomb was dropped over Hiroshima, Mohr had been living in the relative isolation of South Africa, unaware that the nuclear research of his Cambridge days had been applied to the building of the bomb, and unaware that former friends and colleagues such as James Chadwick, Mark Oliphant and Harrie Massey had played a leading part in the Manhattan Project. “I remember the reaction of the Professor of Mathematics at the time who voiced the horror of a lot of people at this event. He saw me one morning and said ‘Mohr, aren’t you ashamed of yourself?’.”

Mohr does not feel that the blame for the atomic bomb should fall only on physicists, or that they should be burdened with any special sense of guilt. “What is true of almost any scientific development that it can be misused. Obviously the same holds for chemistry which can be used to produce poison gas and for biology which can produce biologically destructive weapons. There’s something inescapable that any knowledge can always be applied to evil and destructive ends.”

During the 1950’s and 60’s Mohr tried to publicise these issues as widely as possible through his work for the World Federation of Scientific Workers and through a number of pamphlets published by the Australian Peace Council. On the role played by Australian academics: “I don’t think that they responded as well as they might have done. There’s a sort of pressure on people — scientists as much as others — to conform. It’s very hard to make a stand and scientists in general haven’t reacted to this as positively as they might have done.” Mohr is encouraged by the resurgence of the anti-nuclear movement over the last couple of years. “People are getting more restive and worried about the situation, as well they might. And if they don’t react in a positive way in the next few years, the result will be disastrous for the whole human race. We are rapidly running out of time. It’s a terrible thing that after two World Wars people don’t realize how destructive warfare is, and they will go on thinking in terms of loyalty and patriotism and all these old worn-out cliches. I don’t quite know what you can do until people grow out of these infantile reactions .... It’s very, very sad. I’m not too pessimistic but on the other hand I’m not too optimistic.”

This article is based on excerpts from a videotaped interview conducted by the authors at Gippsland Institute, for the course:

Courtney Mohr retired in 1971, as Emeritus Professor of Physics at Melbourne University.

He had been appointed as the first Professor of Theoretical Physics at Melbourne in 1961.

He now lives at Kew, and is still active in research; a recent paper of his was published in “Australian Journal of Physics” early in 1982.

The Authors

Alistair Carr obtained a B.Sc. (Hons) in Mathematics and Physics, and later a Ph.D. in theoretical plasma physics, at Melbourne University.

He has taught physics and mathematics at various tertiary institutions in Melbourne, and now teaches mathematics at the Gippsland Institute.

He lives with his wife and two young daughters at Jeeralang Junction.

Peter Robertson, whose photograph and biography appear in Aust. Phys. 19, p137 (1981), carried out his M.Sc. work in theoretical nuclear physics under the supervision of Courtney Mohr.

'The Australian physicist, Vol. 20, April 1983 — Page 71'
The Swinburne Travelling Science Show:

Cal. G. Sibley, Coordinator, Science Education Centre, Swinburne Institute of Technology.

What is it?

For a six or seven week season in June/July each year a team of lecturers and technicians from Swinburne Institute of Technology visits secondary schools to present an intensive two-hour program of applied science.

This programme, unique to Swinburne, is designed to stimulate young minds and demonstrate that science and mathematics need not be difficult, dull nor irrelevant to everyday life. The "SHOW" is loosely organised around two themes of continuing general interest, energy and the environment. It consists of a succession of "items" which are demonstrations of principles and applications. Many of these involve participation by members of the audience, and students are encouraged to seek detailed explanations from their own teachers. Closed circuit T.V. is used to ensure that all members of an audience have an opportunity to see exactly what is going on.

The Show itself is unashamedly motivational in intention, seeking to combine entertainment with mental stimulation. Since the major initial input to the Show program came from Physics, it is not surprising that so many items are perceived as "applied physics". Implicit in the Show are messages reinforcing the vocational and social importance of physics as the prime source of the technological and communication developments we enjoy today.

Since the Show's inception in 1973 the cumulative audience has reached 75,000 with around 500 performances each of about 2 hours duration. The current level of operation involves about 60 Shows over a six or seven week period of second school term to a total of around 10,000 students in some 45 schools. (1982 figures: 61, 6, 10, 200, 44 respectively).

How Does it Operate?

The show is run through the Swinburne Institute of Technology Science Education Centre, which enjoys the services of a senior lecturer on half time secondment from the physics department, and a half time secretary/receptionist. A modest budget for running expenses enables the Centre to also offer a wide range of other services to secondary teachers and students. HSC physics options have been catered for through lecture-demonstrations and laboratory work in areas likely to pose problems of expertise and/or equipment in some schools. In all cases, services are syllabus-oriented, represent good value for time spent, and have wider motivational overtones.

The only direct cost in running the Show is the unavoidable consumption of almost half of the Science Education Centre budget. This amounts to a few cents per audience member per year. The work of devising, preparing, setting-up, and presenting Show items is done voluntarily by Swinburne Institute of Technology staff as unpaid, "overtime" activity. Some staff regard the Show as a personal hobby through which they enjoy an outlet for creative urges related to their specialist areas. All four engineering (applied physics?) departments, as well as the physics, chemistry and mathematics departments of the applied science faculty at Swinburne have made valuable contributions to the Show content. A successful item must satisfy the criteria of relevance, ruggedness, portability and reliability before inclusion. Minimum setting-up time is also an important consideration. (At present, setting up requires around 6,000 man hours, about half the total staff time devoted to show presentation).

To establish a Travelling Science Show with conventional costing and financing would require an initial investment of up to $100,000, with an annual budget of $15,000 to maintain the level of the Swinburne Operation. The voluntary efforts of Swinburne staff have kept the Show "on the road" despite the lack of resources remotely approaching the figures quoted above. Extension of the present Show season would require paid staffing, and a dramatic increase in financial resources in consequence. Direct costs would increase by a factor of between 10 and 20, approaching $1 per head of audience. At present, the Show is free to all.

How is it received?

The continuing growth of the waiting list for the Show (it now requires three years to cycle once through the existing list) indicates a high level of acceptance. Staff have been asked to autograph programs, and are frequently astounded at the spontaneous response to the close-of-Show invitation to "take a closer look" and ask questions. A bulging file of appreciative letters is held in the Centre, some from children. Parents have occasionally reported "mind-blowing" stimulus effects on their children and science/mathematics teachers have...
noted continuing class-room effects for up to six weeks after a Show. One would be less than completely honest, however, in neglecting to mention the singular occurrence of hostile reaction on the part of several staff at a suburban high school. These people misinterpreted a remark designed to emphasise the relative importance of English and mathematics at middle school level. One went so far as to state that, while the facts were indisputable, he did not believe that children should be exposed to them!

Can the Show Continue?

Provided that the present modest level of support is forthcoming from Swinburne despite funding problems for the tertiary sector, the Show can continue indefinitely at its present level of operation.

The question naturally arises as to why this endeavour does not attract funding from outside sources.

It is of interest to note the fate of a preliminary approach to the Educational Innovation Fund dispensed by the Schools Commission. The answer was that the Show was “too innovative” to be supported! This occurred at a time when funds were made available for such valuable ideas as “drop-in” coffee houses for teachers to chat in after hours.

Experience of others seeking government funding has been that an inordinate effort must be made in preparing submissions, lobbying, etc., and that ultimate success will fall short of what is needed, in any case.

Private industry has been successfully approached to obtain equipment on loan for the duration of the Show in return for acknowledgement on the printed program. However, the word from the big corporations is that money is a different proposition.

In short, any fund-raising effort could at present only take place at the expense of doing the job for which funds are sought, with uncertain results, at best.

If it could be demonstrated that a powerful vested-interest group in the community could derive a significant short-term financial advantage from the operation of the Show, no doubt funds could be obtained with the possibility of extending the Show to a wider audience.

Wider Issues

One of the pleasant aspects of the Show is the manner in which Swinburne staff from various departments get to know each other in the course of doing something for the cause of education in general. Inter-faculty and Inter-departmental rivalries and squabbles are submerged in the cooperative effort required for success. Much is said at times about “cross-fertilization” as an important ingredient in the generation of ideas. The Show provides a vehicle for this to occur naturally, to the general broadening of staff outlook.

Swinburne staff are justly proud of their efforts in presenting the Show, and would like to see other tertiary institutions involved in similar efforts. The present embattled position of academics is partly due to their failure to be seen to be involved in the educational concerns of the community generally. It is understandable that the general public views with increasing suspicion the commitment of large sums of money to activities which are largely invisible, and certainly not clearly relevant to their own concerns. One such concern is the education, and career prospects, of children. The “closed loop” process by which teachers have been traditionally generated has led to an almost total ignorance of the nature, and range, of opportunities in the physics-based engineering and technical areas. The Show message “no engineering or applied science for you if you drop mathematics” is not generally understood, or appreciated by those who might be expected to recognise long-term growth areas and recommend them to children and parents.

Academics generally seem to be over-concerned with the “publish or perish” syndrome, and fear that involvement at secondary level is somehow demeaning their professional status. Work of long-term national importance such as that of Dr Gore (Questacon, A.C.T.) and the Travelling Science Show needs no apology, and should be widely imitated so that more children can be stimulated to think about the “why” and “how” of their world. At the very least, we might then expect better-informed lawyers and politicians!

What seems to be needed is more action, rather than an endless succession of investigations to establish if there is a problem, how big it is, whether it matters, etc., etc. The time and effort spent on preparing reports would be far better spent in addressing the situation at grass-roots level — i.e. in stimulating, and helping, the next generation to be more aware of, and involved in, the pursuit of scientific studies for their own sake, as well as for attendant vocational advantages.

CSIRO — Universities research link

The joint CSIRO/AVCC Committee has approved six new CSIRO — University Collaborative Research Project Funds. Worth more than $500,000 each year, the Funds are aimed at strengthening the national research effort by encouraging greater interaction between relevant research groups in CSIRO and universities. The universities involved are Melbourne, Sydney, Monash, Macquarie, Wollongong and Queensland.

The Australian Physicist, Vol. 20, April 1983 — Page 73
Comment on “The Nuclear Debate”

B.J. Allen, 5 Muneela Place, Yowie Bay 2228, NSW


In a recent review(1) in the Australian Physicist, Philip Jennings praises the “first full public account” of the British nuclear tests. He concludes by noting that “physicists are accepting their public responsibility to speak-up publicly on nuclear issues”.

I have used Philip Jennings’ book review to introduce my critique because it highlights just how easily the public, and even the physicists, can be hoodwinked by pseudo-scientific journalism. ‘Maralinga’ is not at all an unbiased and complete account of the A-bomb tests; far from it. So I shall take up the gauntlet and accept my own responsibility, not only to the public, but to the physics profession.

The book contains a lot of interesting material and represents a rather concise summary of events leading up to the Maralinga tests and the subsequent trials of the Australian Nuclear Veterans Association (ANVA). However, I must criticise the lack of completeness of the book. The Maralinga revelations rest on accounts by non-commissioned or civilian personnel who would have had only a limited appreciation of the events of the time. This is not to dispute their accounts, some of which appear to be hair-raising, but to question the significance of the events. The authors have made little effort to interview supervisors, officers and scientists — those middle ranking people who might have had a clearer understanding of just what was happening — and at the senior level, quotations from members of the Australian Safety Committee (Sir Leslie Martin and Sir Ernest Titterton) are dismissed out-of-hand.

So much for fullness of research. However, the book is full of hearsay and repeated hearsay.

From the prologue to the epilogue, the bias of the authors is immediately evident. This book is no scholarly discussion providing data so that the reader can make up his own mind. Continually, successive and current governments are accused of bias and cover-up. But the real vested interest lies with a journalist, who knows that emotive books sell, and a health physicist who has a well-known anti-nuclear stance.

Mr. Robotham, the health physicist, is quite capable of presenting an account of the plethora of units of radiation measurement, but is unwilling or unable to come to grips with the statistical uncertainties of small numbers. The authors are also unwilling, or unable, to present an adequate description of the cancer victims, half of whom have no age assigned and most of whom died of ‘anonymous’ cancer. The authors give a table of cancer deaths, impressive to the layman, but of limited use to anyone interested in studying the origin and site distribution of cancers. A complete (?) list of leukaemia deaths is given so these and the ‘all sites’ cancers can be compared with expected values although the authors did not trouble to do so. So let us examine the figures to see just what conclusions can be drawn.

Expected Mortality Rates

Using the cancer mortality rates published by the NSW Health Commission(2) for the year 1977, estimates can be made of the overall cancer and leukaemia rates expected for participants at Maralinga, but these depend on assumptions about the age distribution. If we assume that the age distribution is the same as NSW, then the annual male ‘all sites’ cancer rate would be 1.8 per 1000, and the leukaemia rate 0.066 per 1000.

If we assume a more ‘youthful’ 20-34 years age group for the Maralinga workers in the 1950s, then over the subsequent 30 years the overall age distribution would range from 20-64. For this assumption, rather lower rates are found for ‘all sites’ (1.23 per 1000), and leukaemia (0.040 per 1000), because the high cancer rates of the older age population are excluded.

For the 2000 people at Maralinga(3), over 30 years, the expected, cumulative cancer mortalities would lie between 74-108 deaths for ‘all sites’ and 2.4-4.0 for leukaemia. These results are summarised in Table 1.

A detailed knowledge of the age distribution of Maralinga workers would be needed to obtain more accurate estimates. This will hopefully be achieved in the current Commonwealth survey.

The observed ‘all sites’ cancer deaths taken in the book are about 110 ± 10.5, and for leukaemia 6 ± 2.5, (my errors being derived from Poisson statistics). The excess mortalities (the difference between actual and expected deaths) are consistent with zero if we assume a ‘standard’ age distribution, but are significantly greater than zero for the ‘youthful’ age assumption (see Table 1).

Comparison with Hiroshima and Nagasaki

Leukaemia rates are the most sensitive indicator of radiation effects from A-bomb blast. Survivors of Hiroshima and Nagasaki who received more than 200 rads (cGy) were found to have about 15 times the risk of leukaemia relative to those survivors with no radiation exposure(4). For all other cancers, a factor of only ~ 1.5 was found. Yet it is the ‘all sites’ excess that is the more significant in the Maralinga results for a ‘youthful’ population.

An upper limit to the excess cancer mortality for the Maralinga population can be derived from the analysis of survivors(4) of the Hiroshima and Nagasaki nuclear explosions. The Hiroshima rates, being substantially greater than those of Nagasaki, can be expressed as an excess mortality of 6.2 per 10^5 people per year per rad for all cancers. This result is found for an average radiation dose of less than 50 rad, and corresponds to an expected excess mortality for 2000 people over 30 years of 19 deaths (i.e. 2.6×10^-4). This is about half the excess mortality calculated for maralinga on the ‘youthful’ hypothesis, suggesting radiation doses of twice the average Hiroshima dose. For leukaemia, the excess mortality is 2.1×10^-4, and this corresponds to an excess of 6.3 deaths for 2000 people or nearly twice the Maralinga excess (Table 1).

The Hiroshima excess mortality rates are therefore comparable to the ‘youthful’ Maralinga rates. In that the Maralinga bombs were not dropped directly on our own people, and no immediate radiation induced fatalities are claimed, the exposures must have been well
down on those at Hiroshima. Consequently, the 'youthful' excess mortalities carry little credibility.

The difficulty in detecting A-bomb induced cancers can be gauged from the Japanese experience when only a 10% increase in cancer deaths over 28 years for survivors was ascribed to radiation exposure (4). The average Maralinga dose would have been much less, and the effects would therefore be statistically unobservable. 

What were the doses at Maralinga and who received them? This data should be available and made known to the participants. It may be that some staff did receive high doses which significantly contributed to their probability of developing cancer. However, it is clear that at this stage most cancers could not be ascribed to Maralinga. Because of this, the authors have caused needless distress to the families of past and future cancer victims.

Table 1. Cancer Mortality

<table>
<thead>
<tr>
<th>Population Age Distribution</th>
<th>Cancer Mortality</th>
<th></th>
<th></th>
<th>Excess Mortality</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>per 1000 males p.a.</td>
<td>30 y for 2000 males</td>
<td>Excess</td>
<td>all sites</td>
<td>leukemia</td>
</tr>
<tr>
<td></td>
<td>all sites</td>
<td>leukemia</td>
<td>all sites</td>
<td>leukemia</td>
<td>all sites</td>
</tr>
<tr>
<td>Maralinga*</td>
<td>3.5 ± 1.3</td>
<td>—</td>
<td>110 ± 10.5</td>
<td>6 ± 2.5</td>
<td>—</td>
</tr>
<tr>
<td>(1975 only)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW Standard</td>
<td>1.80</td>
<td>0.066</td>
<td>108</td>
<td>4.0</td>
<td>2 ± 10.5</td>
</tr>
<tr>
<td>NSW 'youthful'</td>
<td>1.23</td>
<td>0.040</td>
<td>74</td>
<td>2.4</td>
<td>36 ± 10.5</td>
</tr>
<tr>
<td>Hiroshima</td>
<td>50 rad average</td>
<td>19</td>
<td>6.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* These are the only data given in the book for Maralinga veterans. The errors are mine.

Satellite surveying

Technology which helped track stricken Soviet satellite Cosmos 1402 was demonstrated in a different capacity at the University of Queensland recently. At a one day seminar hosted jointly by the University’s Department of Surveying, experts demonstrated the use of satellites in modern surveying techniques.

A seminar organiser, Surveying lecturer Dr Karl Bretreger, said surveying by satellite was not widely used in Queensland, mainly because surveyors had not in past years been trained in its application.

Dr Bretreger said the technique, known as doppler positioning, had particular application for large survey tasks and was widely used at sea to position ships.

“It is faster and more accurate than traditional techniques for survey work across vast distances or through difficult terrain.”

“If the survey work is for items such as gas pipelines or transmission lines, doppler positioning will survey the best and straightest route. Aerial photography will then fill in the topographical gaps.”

Dr Bretreger said a major project using the system was the surveying and mapping of Cape York this year by the Australian Army.

This would considerably improve knowledge of the region and update inaccurate maps made several decades ago.

REFERENCES

3. The authors quote a figure of 2000, but the 'Sydney Morning Herald' reporting a spokesman for Senator Carrick, refers to a Commonwealth screening of an estimated 11000 people directly involved in the Maralinga program.

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Phone (09) 350 7093

The Australian Physicist, Vol. 20. April 1983 — Page 75
LETTERS
Nuclear Debate

Dear Sir,

Thank you for the opportunity to reply to the letters by L. Munslow-Davies (February issue) and B.J. Allen (April issue). I am pleased that they have set forth their views on the books I reviewed because the principal objective of my essay review was to stimulate physicists to read and discuss these books. Nuclear issues are amongst the most important problems facing our society and I believe that physicists have a responsibility to contribute to an open, informed debate on these topics.

Both your correspondents are critical of some aspects of the books I reviewed. This is understandable as the interpretation of statistics on public policy is usually the subject of dispute (e.g., the debates over smoking and cancer and diet and cancer). Their comments also reflect the wide spectrum of opinion amongst experts in the nuclear field. I am however surprised that they both attack the objectivity of the authors of the books I reviewed and imply that they are more objective themselves. It is not possible to be objective about such vital public issues as nuclear energy and nuclear war. We all bring our value judgements to bear on the interpretation of the scientific facts and thus come to different conclusions. It is pointless to accuse Robotham or Gofman of deceit as your correspondents do, simply because they do not share their basic values. Scientific facts may be value-free but science policy is not.

The role of value judgements in technological decision-making is now fully recognized. (See for example D. Alpert, "Science, Technology and the Future", J. Vac. Sci. Tech. 18 (1981) 143-147.) A wise government should not rely solely on the views of a selected committee of experts but should seek opinions from independent assessors and the general public before making decisions on technological issues. Our experience with nuclear weapons illustrates clearly the disasters which can result from a reliance solely on the views of experts. For example Robotham and Tame describe (Maralinga p 196 et. seq.) in the fifties the most distinguished radiation authorities in the USA assured the farmers of Nevada that fallout from the American nuclear tests was harmless. Now thirty years later this advice is completely discredited but many have suffered as a result of it.

The debates over nuclear and radiation issues have been long and bitter. The imprecise language of your correspondents illustrates the type of mudslinging that characterizes this field. However it is commendable that despite abuse and ridicule from the nuclear establishment, there are still many courageous, independent physicists such as Gofman, Falk and Robotham who are prepared to speak out and inform the public and the scientific community of their views on these vital issues.

PHILIP JENNINGS
Murdoch University

Dear Sir,

I would like to draw attention to an advertisement for an academic position which appeared in the "Australian" on 16 March 1983. The position was in the Physics Department of the University of Western Australia. The advertisement stated that the successful applicant would have a "significant research record" and would join "one of the existing research groups" a list of which followed. "Atomic physics, particularly electron scattering or laser physics" was the stated preferred area. The advertisement further went on that, "Applicants should hold a higher degree in physics and have shown competence in teaching a tertiary level" since the successful person would be required to take a "full part in the Department's teaching programme".

So, from the sound of it, here we have a physics department looking for a top class physicist to take up full academic duties. The position advertised must surely be at least for a lectureship, correct! Wrong! Here we have a department demanding all of these qualifications for a Temporary Senior Tutorship. Eighteen months, with a small carrot of "some prospect of continuation".

I for one condemn such attempted exploitation of the employment situation of young physicists. The action of this physics department headed by J.F. Williams represents a complete misuse of the position of Senior Tutor which was designed for non-career academics to supervise tutoring within a department. The change in recent years to Universities using these positions (which are careers-de-sacs) to employ good young post doctorates to perform full academic duties at a much cheaper rate is shown at its worst by this advertisement. When is it for the Institute to protest about these practices? Or does the Institute and more precisely the Executive condone such actions by Universities?

W.R. MACGILLIVRAY M.A.I.P.
School of Science Griffith University, Nathan, Q.

Dear Sir,

Prompted by the paragraph in Vol.20 — Postgraduate Studies in Occupational Safety — may I draw your attention to the Graduate Diploma of Occupational Hygiene conducted at Deakin University. Having commenced in 1978, this course is the only one in Australia providing a formal qualification in Occupational Hygiene.

The course consists of four lecture units covering the topics of Sampling and Measurement, Toxicology, Human Factors and Radiation, plus a project in which the student carries out a major investigation in his/her workplace. The course is available on a full (1-year) or part-time basis.

Students have been graduates in Physics, Chemistry, Biology, Engineering, Health Sciences, and Medicine. Yours sincerely,

Bernard Jordan,
Co-ordinator of the Graduate Diploma

Information Engineering

The establishment of a Department of Information Engineering within the Research School of Physical Sciences is among five major proposals which the University has included in its submission to the Universities Council for the 1985-87 triennium. This would require special funding as a new project, and additional accommodation.

The continuing cost of the Department of Information Engineering would be $630,000 per annum, with an additional cost of $400,000 for equipment. Noting that the University's resources in applied physical science are small in proportion to its presence in the fundamental sciences, the submission says that the ANU believes that the greatest need and most promising prospects lie within the network of the converging disciplines associated with information, communication and microelectronics.
BOOK REVIEWS

Reviewed by G. Kossoff, Ultrasound Institute, Sydney

Ultrasound interfaces many fields of experimental physics and this volume offers a detailed and comprehensive treatment of a number of topics in the broad field of ultrasonics and consists of 12 chapters discussing principles of ultrasonic fields, piezoelectric transducers, velocity and attenuation measurement techniques, dynamic viscosity measurement, chemical relaxation spectroscopy, scattering in polycrystalline media, non-linear phenomena, cavitation, low temperature physics, acoustic optic phenomena, surface elasticity waves, acoustic holography and computerised transmission tomography.

The editor has been fortunate to attract some of the leading scientists in their respective fields and the material is presented in a clear and authoritative manner. Indeed the volume bears close similarity to the format previously adopted in a series on "Physical Acoustics" edited by W.P. Mason. The constant developments in ultrasound require frequent up-date volumes and the book is considered an essential addition to the library of scientists interested in access to modern developments in ultrasonic physics.

Reviewed by B.M. Spicer, School of Physics, University of Melbourne.

This book adds one more to a rapidly-growing number of first year university text-books which are directed towards students whose science degree involves a major study in the health sciences. The author states that he has written specifically for students in the allied health sciences (physiotherapy, occupational therapy, etc.), nurses and physical education majors. The mathematical level of the book is low, and, importantly, the book succeeds well in providing a heavy lacing of the physics topics with examples from the health sciences.

The major part of the book is concerned with mechanics and properties of matter — solids, liquids and gases. Diffusion and osmosis are discussed totally within the context of the cell membrane. Relatively short chapters on electricity, and waves form a weakness in the book, though the latter topic is applied to hearing and sound, and light and vision. There is a satisfactory treatment of x-rays and radiation, given the level of this book. It is pleasing to see sections on electrical safety and radiation safety.

In summary, this book is certainly a satisfactory one for those students at whom it is aimed. For medical, dental science and veterinary science students it provides a very useful collection of situations in the health sciences where physics has application.

Reviewed by A.G. Klein, School of Physics, University of Melbourne.

This volume contains six extensive reviews of fairly specialised subjects ranging from the highly theoretical to the largely technological. On the theoretical side, Electrons at Interfaces by Marvin L. Cohen will appeal mainly to specialists. On the technological side, Electronic Watches and Clocks by A.P. Gnadiger is a beautiful article, likely to be of general interest to those who were curious about the "works" of their quartz wristwatch but didn't learn much when they opened it up. I was interested to note that the author, originally a member of the Swiss watch industry, where many of the developments originate, has now "drained his brain" to Silicon Valley which, together with the Japanese, holds the lead. The electronics is, of course, relatively trivial compared with microprocessors or even pocket calculators, but the challenge posed by display technology and, in particular, by available types of battery, required ingenious solutions and compromises.

Other articles likely to be of general interest include: Beam Waveguides and Guided Propagation by L. Ronchi and A.M. Scheggi; Charge Transfer and Surface Acoustic-Wave Signal Processing Techniques by R.W. Brodersen and R.M. White; and Gunn-Hallum Effect Electronics by M.P. Shaw, H.L. Grubin and P.R. Solomon. The first of these explains the transition from metal waveguides for microwaves to dielectric guides as optical fibres. The latter two will educate you on CCD's, SAW's and Gunn diodes, buzz-words of new technologies that have begun to penetrate our high-tech world.

Reviewed by R.L. Dalgliesh, School of Physics, The University of New South Wales.

This book is the second of the two volume work designed to update the Editor's previous standard work, "Focussing of Charged Particles" (Septier, 1967). The first volume of this current work was published about a year ago (review in Australian Physicist, August 1981). This second volume contains six articles, the first three dealing with major applications of ion beam machines, viz.

1) Secondary Ion Microanalysis.
2) Ion Implantation Technology.
3) Electron Beam Lithography.

These three articles are all well up-to-date and start from basics but quickly arrive at problems and solutions used in current technology. The treatments are suitable for interested beginners and form good reviews for those knowledgeable in the field.

The final three articles describe the present level of knowledge in three important applications of charged particle beam manipulation:

4) mass Spectrographs,
5) Radio Frequency Quadrupole Mass Spectrometers,
6) High Resolution Electron Spectroscopy.
These three articles represent very good, comprehensive
reviews of the development and current knowledge of these
applications. The level again is a very good
compromise and would suit all levels of readers; all have
very thorough references.
In summary, this second volume should be much
more useful than the first volume of the set where the
level of treatment was variable and generally lacked the
information that a reader would expect in a work
titled "Applied Charged Particle Optics". This second
volume should be an excellent reference and review
work for anyone who uses or is interested in charged
core particle beams.

A FESTSCHRIFT FOR MAURICE GOLDBACHER,
G. Feinberg, A.W. Sunyar, J. Weneser (Eds.), The New
York Academy of Sciences, 1980, x + 293pp., US$75.
Reviewed by B.M. Spicer, School of Physics, University of
Melbourne.
This volume consists of some twenty-four short essays on
subjects extending across a wide range, from
quantum chromodynamics to mechanical and
thermoelastic properties of composite materials in the
plastic range. It was assembled in celebration of the
seventieth birthday of Maurice Goldhaber, a member of
the Brookhaven National Laboratory since 1950, its
director from 1961 to 1973, and since then an
Associated Universities Inc. Distinguished Scientist.
The range of topics covered in these essays represents
quite well the range of topics which the research
activities of Maurice Goldhaber have covered. These
latter have included studies of nuclear disintegrations by
photodisintegration experiment (of the deuteron) to
measure accurately the neutron mass, followed by a long
series of experiments on the emission and absorption
of gamma rays by the nucleus, including the paper with
Teller in which the idea of nuclear collective motion was
introduced and applied to the phenomenon we know as
the giant dipole resonance. In later years his activities
turned more towards particle physics, although he never
really "let go" of nuclear physics, choosing rather to use
it as a tool in some most ingenious experiments such as
that determined the helicity of the neutrino.
Most recently, he has developed an interest which
began in the early 1950s, namely the testing of
conservation laws.
Thus one finds in this volume essays on neutron
radiative capture (RE Chrien), photodisintegration (P.
Axel, and E. Hayward and R.G. Leichti), nuclear
isomerism and isostatic traps (E. der Mateosian), M4 matrix
elements (I. Talmi), the search for new isotopes (D.E.
Alburger), and on to the influence of the nuclear
medium on the lifetime of the proton (C.B. Dover and
L.C. Wang), asymptotic freedom (S. Drell), superallowed
Fermi decay and the quarks (D.H. Wilkinson), tests of some conservation laws (F. Reines
and H.W. Sobel), to name a few. There are also some interesting questions posed: Contact with hidden
magnetic poles? (A.S. Goldhaber); Is the physical vacuum a medium? (T.D. Lee); Is the muon a multipole
meter? (E. Teller and M.S. Weiss); Does violation of
microscopic time-reversal invariance lead to the
possibility of entropy decrease? (C.N. Yang and C.P.
Yang).

Each of the twenty-four essays in this volume is a
choice morsel in its own way, to be read slowly,
pondered upon, and its taste enjoyed. Together they
represent a fine tribute to a physicist who has had a
great impact on the development of his subject, but
whose contributions are largely unsung.
From a parochial Australian point of view, it is a
shame there is no contribution from Melbourne-born
R.D. Hill, who worked with Goldhaber at Cambridge
and later at the University of Illinois.

THE FORCES OF NATURE, P.C.W. Davies,
Cambridge Univ. Press, Cambridge, 1979, viii + 246
pp., £4.25 stg. (P/B). Reviewed by D.W. Lang, AAEC Lucas Heights
Research Labs., NSW.

The aim set out in the Preface is to provide a
description, without advanced mathematics, of concepts
that become important in sub-atomic physics. The result
is both readable and an excellent guide. Starting in the
family, world, gravitation and electromagnetism are the
controlling forces of almost all things seen. After several
generations of 'elementary particles', the limits of current
experiments are approached. It appears that the strong
and weak fields that emerged along the way may be
combined with gravity and the previous syntheses of
electricity and magnetism to make a single unified
theory. On the back cover a considerable set of possible
readers seeking knowledge of physics is suggested. All
of these should benefit. Added to the set should be those
whose task is to explain ideas in physics. I am usually
wary of back covers which say that an author "... writing in the same vivid and readable style as in his
widely acclaimed Space and Time in the Modern
Universe, here presents an authoritative account of ...
especially as I have not read the first book. Having now
read the second, the first is likely to follow.
The clarity of explanation is always excellent. Where
understanding is limited by avoiding mathematics, this
is indicated. Much is achieved in discussion based on
well-constructed diagrams. There is a faint query here.
Can it be assumed that those who want to read about
modern physics are already self-selected as having
geometrical intuition, trained or not? My own intuition
and an early training in which geometry and algebra
were almost divorced, probably disqualified me from
answering.
Readers familiar with "Mr. Tompkins in
Wonderland" may miss some of Gamow's fireworks.
Simplification here has a different purpose. Where
Gamow aimed to give a glimpse with some insight into
the fantastic alterations of perception required by the
new mathematical descriptions of the universe,
explanations here are more thorough and lay less
emphasis on the contrasts with events on a geographic
scale. Much of the material is structured historically,
but where Mr. Tompkins encountered un-named
personalities, the names and nationalities of discoverers
are recorded here without their personalities.

Purists may quarrel over the use of fermis versus
femtometres. Rutherford's Nobel Prize, awarded in
1908, is made to appear a consequence of his work,
several years later, on the nuclear atom. The tails of
comets are connected with light pressure rather than
with the solar wind.
These are minor matters. I could not fault the index
and I both enjoyed and learned from the remainder.
BRANCH ACTIVITIES
Victoria

“The Ubiquity of Alpha” was the title, the omnipresence of the fundamental constants the theme, of Professor George Series’ lecture to the first 1983 meeting of the Victoria branch.

The fine structure constant, \( \alpha = 1/137 \), has been with us at least since the velocity of an electron in the first Bohr orbit of hydrogen was noted to be \( \alpha c \) (c = velocity of light in vacuum), but the fundamental constants such as \( \hbar, c, \) various mass and magnetic moment ratios etc. have come a long way since then; to an accuracy of a few parts in \( 10^9 \) in several cases.

Professor Series is well qualified to talk on such topics, having pursued a lifetime commitment to atomic spectroscopy and the fundamental constants, first with studies of the Lamb shift and spectral fine structure in hydrogen and helium, and later of optical pumping and laser physics. If Mr. and Mrs. Series had called their new son Balmer instead of George it would have completed the picture perfectly, Geoff Opat noted, for Professor Series had been in every other way an ideal member of the select group of physicists who find themselves at home with the constants: knowledgeable over a wide range of physics but with a penetrating nose for inaccuracies and an uncommon persistence in pursuing particular experiments to their absolute limit.

The speaker emphasized the important difference between defining a unit and being able to reproduce it for practical use. Thus, while the ampere might be defined as “the constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular sections, and placed one meter apart in vacuum, will produce between them a force of 2 x 10^-7 Newtons per meter” it was quite another matter to use this definition quantitatively in the laboratory! This had been finally done, it was pointed out, using the Lampard capacitor and the Josephson voltage. Similarly, the kilogram was defined as the mass of a lump of PtIr metal kept in air in a vault in Paris, but one wondered about inaccuracies introduced by surface absorption and contamination, and how the unit was to be reproduced accurately around the world.

By contrast, time was far better defined (to one part in \( 10^{10} \)) using the Cesium clock, and further improvements using lasers in the visible range were foreshadowed. With the speed of light recently decreed to be precisely \( 299,792,458 \) m s\(^{-1}\), the need for a realizable unit of length was thus replaced by the quite realizable time (or frequency) unit.

The lecturer then returned to \( \alpha \), with a plot of its value versus time showing a convergence on a value accurate to one part in a million; and finally to the 1980 von Klitzing discovery of a low temperature Hall effect in two-dimensional electron flow, and its implications for future standards work.

Professor Series had begun by noting that small discrepancies between experiment and theory had led to numerous new pieces of physics in the past; he concluded by warning that any current agreement to high accuracy between experiment and theory was too good to be true and must be a source of suspicion and further study. Only a standards man could make both statements with such conviction!

It all reminded me forcefully of George Fuller’s introductory physics lectures at Adelaide University in the 1950s, when he encouraged us to think about estimation and orders of magnitude as well as high accuracy, the basic physics behind phenomena as well as the fine structure, uncertainties and errors in the laboratory as well as the answer, and also its units. As Professor Series warned, the fundamental constants, like the topics just listed, can be exquisitely dull; and yet in the right hands they can be interesting and enlightening. It is perhaps a sign of this correspondent’s age that he must conclude by noting that these matters are also absolutely basic to the discipline we call physics.

John Jenkin

Wagga Solid State Meeting — 1983

To visit Wagga Wagga in February requires a strong personal motivation. Nevertheless, a significant fraction of the solid state physics community has done just this for the past seven years, with the exception of 1980 when the meeting was held at Pakatoa, New Zealand. This year’s 123 participants at the Seventh Wagga AIP Solid State Meeting, held at the Riverina College of Advanced Education, were subject to a variety of climatic conditions extreme enough to discourage anyone; 43°C temperatures, dust storm fall-out and freezing rain, all in a period of four days. Fortunately, the high standard of the meeting more than compensated for such discomforts.

In view of the fairly well-established format for the Wagga meetings that has evolved over the years, the Canberra-based working members of the Organizing Committee, Geoff Wilson (Chairman), Glen Stewart (Secretary), Peter Lynam (Treasurer) and Geoff Whittle, are to be congratulated on the innovations they introduced into this year’s meeting. The comfort provided by the seating and air conditioning in the new Keith Swan lecture theatre more than compensated for the uphill trek to get there and could mean an end to the “Wagga back” syndrome associated with the seating in the traditional Jories Hall venue. The inclusion of a specific period within the timetable for author attendance at the poster presentations was highly successful and initiated a great deal of discussion. A significant improvement was evident in the overall quality of the posters compared with previous years, which may have been inspired by the award of prizes in the form of bottles of champagne for the three best posters in each of the two sessions. The initiation of sponsorship and advertising in the handbook, irrespective of whether the latter is appreciated or not, had a significant impact on holding down the costs of the meeting and provided for the updating of the Australian and New Zealand Solid State Physics Research Directory. With entries for solid state research groups in 40 institutions, and over 300 individual research workers, this new issue of the Directory is a comprehensive and valuable guide to solid state research in Australia and New Zealand. Copies of the Directory may be purchased for $5 from the Hon. Secretary of the Institute.

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The format of this year's meeting was divided between orally-presented, invited papers and contributed poster papers. With a total of 16 invited papers it is impossible to report on each individually. It was impressed upon all invited speakers that their primary role was to educate rather than overwhelm and they responded to this admirably. The range of topics was impressive, embracing phase transitions, metallic glasses, magnetism, low temperatures, semiconductors, geophysics, applied physics, biophysics, plasma physics and the liquid state. The latter topic prompted Guy White to suggest that it was time to consider adopting condensed matter as the title for future meetings.

The language of gamesmanship, no doubt inspired by the World Cup Series, achieved new dimensions in the description of the spectroscopy of solids as presented by Neil Manson. Not to be outdone, Brian Window retaliated with an unconventional mixture of soccer and Australian Rules in his description of gas discharges. However, the final play went to Trevor Finlayson with his visual aids to his presentation on structural transformations. Paul Clark proved it was possible to capture the attention of an audience with a few well-chosen words, without the use of a microphone, and Graham Bowden was equally successful by repeatedly dropping one.

With 77 posters to review, the two judges, John Collins and Trevor Hicks, were faced with a difficult and demanding job. In commenting at the presentation of prizes to the winners, John stressed that the

judgement had been based upon the clarity of presentation and the success in conveying information rather than artistic niceties. For those belted of computer-produced text, he warned against the danger of producing lengthy, involved and difficult-to-read text.

Next year it is again the turn of the New Zealanders and the arrangements have been made to hold the meeting at Paekakariki between February 7-10. Advance information may be obtained from the Secretary to the Organizing Committee, Dr. J.L. Tallon, Physics and Engineering Laboratory, D.S.I.R.; Private Bag, Lower Hutt, New Zealand. The future of the Wagga meetings, in particular that for 1985, was discussed in view of the likely unavailability of the College during the traditional Wagga week due to the increasing popularity of the courses presented by the College. It was agreed that it was essential to maintain the informal atmosphere that is such an important aspect of the Wagga meetings and, if possible, retain the venue. A provisional booking for the first week in February, 1985, has been made by Guy White, the elected Chairman for 1985.

In order to avoid a possible clash of interests in 1985 between the Solid State meeting and the eighteen-monthly meeting of the Crystallographers, Frank Moore put forward a proposal to combine the two meetings. Concern was expressed that this would make the meeting too large and necessitate parallel sessions. It was suggested that the most satisfactory arrangement would be for the two meetings to be held consecutively.

T. F. Smith

INIS Database open for online searching

The Australian Atomic Energy Commission's INIS computer database is now open for online searching. The main scope of the information is described as "nuclear science", but areas as diverse as solid-state physics, cosmolgy, radiation chemistry, nuclear controversy, industrial and medical uses of radioisotopes and radiation, uranium mining and enrichment are extensively covered. The database is very large, containing over 700,000 references to items published since 1972.

INIS, which stands for International Nuclear Information System, boasts worldwide coverage of information through its fortnightly intake from 48 countries and international organizations. About one-third of the references are research reports, the bulk of the database consisting of journal articles, conferences, books and patents. Computer programs, maps and films are also included.

Access to the database is by dial-up lines directly to the AAEC, or, from mid-1983, by the Australia-wide CSIRONET computer network. The simple retrieval language used to select the data was designed at the AAEC and users should quickly become familiar with it.

Complete search privacy is guaranteed on the AAEC's IBM 3033 computer. At $25 per connect hour, searches of the database can be made quite inexpensively. References may be printed offline, usually at 3 cents per reference (minimum $3), some longer, at 5 cents (minimum $5).

The database is available for searching 24 hours a day. Assistance can be provided during normal working hours if required.

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THE UNIVERSITY OF TASMANIA

Research Fellow:

Theoretical

Chemical Physics

To undertake theoretical studies on the electron properties of molecules, in the Department of Chemistry. A strong background in Applied Mathematics, Chemistry or Physics is required, with a sound knowledge of computing. Appointment on a full-time contract basis for two years but subject to satisfactory performance review after first year. Salary will be within range $19,333 — $21,583 p.a. with some provision for travel costs.

Enquiries to the A.R.G.S. Grantee, Professor F.P. Larkins, Tel. (002) 202158. Applications, including curriculum vitae and names and addresses of referees, close on 18 April, 1983 with the Registrar, University of Tasmania, Box 252C, G.P.O., Hobart, Tasmania, 7001.
Crisis point

Jim Piper takes up the Chairmanship of the Research Committee at a time which can only be described as a crisis point for the university research funding.

The Commonwealth Government is squeezing funding agencies such as the Australian Research Grants Scheme, of whose yearly allocation Macquarie University receives only 5.1 per cent ("rather less than in proportion to our size", he points out.

"It is important that the right of individuals (in universities) to carry out academic research of their choice be maintained and the threatened loss of this right is perhaps the most dangerous aspect of the present situation."

***

John Birch of the Division of Applied Physics CSIRO, recently left Australia to undertake a 10 week study of the relationship between Government and non-Government aid programs. John, who is National Chairman of Community Aid Abroad in Australia, is undertaking the tour as a recipient of a Churchill Fellowship. John will be attending the Oxfam Conference in Mexico and the Council Meeting of the International Council of Voluntary Agencies in Geneva. He also expects to visit non-Government organizations in North America, Western Europe and South East Asia to document and analyse their experiences as recipients of Government aid.

***

Sir Leslie Martin's death earlier this year is recorded with regret. A more adequate notice will appear in next month's issue.

***

Staff and former employees of the CSIRO Division of Applied Physics were saddened by the death just before Christmas of Norman Esserman who was formerly Chief of the Division of Metrology. Norm, who was 86, graduated in physics from the University of Sydney in 1916, and had been associated with CSIRO since 1939, until his retirement in 1961.

***

Three members of the above Division have retired recently. David Brown, who had been responsible for the high-voltage calibration work, Roy Talley, who had been working as a signwriter, and Penny Riley, who had for eight years edited the Division's newsletter. The new editor of the newsletter is Susan Huddleston.

***

The death occurred recently of Dr Geoff Hill, a senior scientist in the Division of Mineral Chemistry at Port Melbourne. Geoff suffered a fatal heart attack travelling home.

He joined the Division of Radiochemistry in 1949 as a part-time technical assistant, graduating from the University of Sydney the following year as a B.Sc., and as an M.Sc. in 1955. In 1961, he was awarded a Ph.D. from the University of Melbourne for his thesis on

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"Advanced Programming of Digital Computers". Geoff was intimately involved in the development of CSIRO's first computer, CSIRAC which was, at that time, the fourth computer in the world. He applied his professional skills to a wide range of problems; wheat yields, rainfall, library systems, accounting systems, soils and geomechanics to mention but a few to illustrate his diversity of interests.

In the early 1970's, his attention moved towards the then-emerging field of geostatistics, and made this area his future career.

***

Those who have used any of the well-known texts by Gaylord P. Harnwell will be interested to hear of his death in USA at the age of 78 after a long and distinguished career. His obituary is in Physics Today of October 1982.

***

Professor Hugo Messerle, Professor of Electrical Engineering at the University of Sydney, has been elected a Fellow of the U.S. Institute of Electrical and Electronics Engineers.

In its citation, the Institute said the award had been made "for leadership in education and research in energy conversion and electric energy systems'.

Professor Messerle heads the University's MHD research program. MHD (Magnetohydrodynamics) is a new method of generating electricity which promises to lift the present efficiency of 35 per cent to about 50 per cent. This will result in large savings of fossil fuels, and reductions in environmental pollution.

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Visitors to U.Q. Physics Department

Professor D.E. Loper (Webster Fellow) of Florida State University, from January to June 1983. Activities/interests: Geophysics — problems dealing with convection in the earth’s mantle. Contact: extension 3369.

Dr Haralds F. Petersen of the Australian National University, from January 1 to June 30, 1983. Activities/interests: Mathematical geophysics. Contact: extension 3410.

Mr Xu Chang Fang of the Institute of Geology, State Seismological Bureau Beijing, China, from February 1982 to the end of 1983. Activities/interests: Magnetotelluric techniques. Contact: extension 3423

***

Following the retirement in mid-December 1982 of Sir Geoffrey Badger, Professor R.O. Slatyer, AO, FAA, FRS, has been appointed Chairman of the Australian Science and Technology Council (ASTEC). Professor Slatyer is Professor of Biology at the Research School of Biological Sciences in the Australian National University.

***

Professor Peter Mason, Professor in Physics at the School of Mathematics and Physics of Macquarie University, has been elected Vice-President of the Australian Institute of Nuclear Science and Engineering.

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Physics Roundabout

Slow progress

Falling demand for electricity due to low economic activity, and problems of financing and licensing are blamed for the slow progress of nuclear energy recorded by the International Atomic Energy Agency in its annual report for 1981. The total installed nuclear power capacity in the world did increase by 13% over the same period, however.

By the end of 1981, 272 nuclear power reactors were operating in 23 countries, with a total installed generating capacity of 152603 MW. Only seven of these plants, with a total capacity of 2465 MW, were in developing countries. The total installed capacity represents 7% of the world's total electricity generating capacity, and it produces approximately 9% of the world's electricity. By 1985 some 17% of the world's electricity will come from nuclear power stations, since 236 reactors now under construction will have come into service.

From full economic studies, the IAEA has concluded that electricity from nuclear power will continue to cost substantially less than that from oil-fired generation, and it can compete with coal-fired generation, except in locations with low-cost coal supplies. During 1981 the IAEA began work on improving its ability to assess the role of nuclear power in meeting the world's energy requirements, particularly in the developing regions, and it has continued to train skilled manpower in those developing countries planning to implement nuclear power programmes.

A computerised power reactor information system has been set up, for use in operational planning for nuclear plants, and further progress was made in 1981 on the IAEA's expanded safety programme. Safeguards activities increased, and the joint programme with the UN's Food and Agricultural Organisation has continued to assist developing member states solve agricultural problems through the application of isotope and radiation techniques. The total number of active participants in the International Nuclear Information System (tnis) rose to 80, and the tnis bibliographic file now contains over 640,000 items. Physics Bulletin

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Methodists' conclusions on nuclear power

In all the discussions which have occurred throughout the world concerning mankind's justifiable fears about the horror of nuclear warfare the place in the scheme of things for peaceful uses of nuclear energy is sometimes obscured. It is interesting to read the findings of a two-year study by the Home Mission Division of the Methodist...
Their conclusions on the study of nuclear power are summarised as follows:
1. Nuclear energy is an integral part of nature, just as much God’s creation as sunshine and rain.
2. It does offer mankind a new energy source which is very large, convenient and not very costly.
3. Around the world the most important energy sources, oil in the rich world and wood in the poor, are becoming scarce, so that we cannot afford to set aside any energy technology with large potential which is effective, provided it is reasonably safe.
4. There are risks associated with use of nuclear power, as with everything else, but these have been very carefully evaluated, are not very big and are not at all out of scale compared with risks of other energy sources and other ordinary hazards.

C. Crellin
Engineers Australia

Young supernova remnant

Four ANU astronomers at the Mount Stromlo and Siding Spring Observatory, Coonabarabran, have discovered the youngest supernova remnant yet found which exploded over the Southern Hemisphere probably less than 200 years ago. This unique discovery allows astronomers to view, for the first time, the innards of a star and directly test theories of the evolution of stars.

The explosion would have resulted in the brightest star in the Australian sky and would have remained so for six months. It would have been particularly noticeable as it was far from the Milky Way.

“We are hoping that Australian will search through their ancestors’ pioneering diaries for a mention of this or other later naval adventurers,” Professor Mathewson said.

Professor Mathewson said it was quite possible that historians or archivists had come across a mention of such a star but had not known of its significance to astronomers.

At the courts of China, in India, Persia and Egypt, the court astronomer paid close attention to supernovas and interpreted them as omens or propitious signs for declaring war, for increasing taxes or for festivities.

This chronicle of astronomical events is missing in the Southern Hemisphere. It might, however, have appeared in Aboriginal art or ritual.

In more scientific terms, the bright star which appeared last century was caused when a very young star, a million years old, and fifty times more massive than our sun, suffered an energy crisis and blew itself to pieces. The energy released in this catastrophic event would account for the six months appearance of the bright star. What the ANU group found was the debris of the central core of that star.

Professor Mathewson made the discovery with Dr Michael Dopita, Dr Ian Tucci and Mr Vince Ford. We were observing at the Anglo-Australian telescope at Siding using standard techniques for the detection of supernova remnants. We were looking at a region of the sky from which intense X-ray emissions had been detected by the Einstein satellite. This revealed nothing. We then inserted an oxygen filter into the light beam. Within seconds such an intense light appeared on our television displays that we felt very excited.

This was tempered by concern that we had damaged our very sensitive light detecting system.

Surface

“It was tremendously stirring because we then all realised, simultaneously that we had something “big on the line”. What we were seeing was the pure innards of a star, the guts you might say, which had not been contaminated or diluted by the usual gasses out in space.

Normally you can only observe material at the very surface of a star and have to speculate about its interior which is where the fusion process builds the elements so important to the origin of life. The explosion releases these heavy elements into space and this chemically enriches the inter-stellar gasses from which planets such as earth were formed.”

ANU Reporter

New research centre for Maths Sciences

A Mathematical Sciences Research Centre is to be established within the Research School of Physical Sciences ANU. The basic objectives of the Centre will be the advancement of research and training in the mathematical sciences, including computer sciences and statistics, both within the University and nationally, and the promotion of worthwhile interaction between mathematicians and other scientists.

It is hoped that the new Centre will serve as a focus to bring together mathematicians and statisticians who are at present dispersed in six departments across two Research Schools and two Faculties.

In 1981 the University provided $25,000 for a Mathematical Visitors’ Program under the Institute’s ‘New Initiatives’ scheme and a further $40,000 was budgeted for 1982 from the same sources.

These funds have been and are being used to support visitors to the six departments most closely allied to the mathematical sciences, including the former Department of Applied Mathematics, The Faculties.

It is hoped that the level of funding budgeted by the University for the Centre in 1982 can be maintained in subsequent years.

Inter-Government Oceanographic Commission (IOC)

Australia has been successful in its bid for election to the Executive Council, which is the principal organisation concerned with international marine science. The 32 member Executive Council exerts considerable influence on the policies and program priorities of the Commission and it is important that Australia be involved in its workings.

In particular the Executive Council is in a position to influence the development and operation of the IOC’s regional groups. Australia is a member of one of these regional bodies, WESTPAC, the Program Group for the Western Pacific.

The Australian representative to Executive Council meetings will be Mr D.G. Keeley, Assistant Secretary, Sectoral Policy Branch, Department of Science and Technology.
Energy 83

Canberra, May 11-13 1983
“Towards an energy policy for Australia”
The culmination of an extensive two-year review program, undertaken by 150 of Australia’s leading engineers and scientists.
The program:
Opening — Sir Ninian Stephen, Governor-General of Australia.
Conference Review — B. Kirkwood, SEC of WA.
Workshops — Each session will be followed by workshops which will enable delegates to express their views on the issues of the preceding session.

Nuclear War Symposium

An Australian National University special Public Affairs symposium on the consequences of Nuclear War for Australia and its region will be held on Monday and Tuesday 30th & 31st May in the Coombs Lecture Theatre, A.N.U.
It will be a timely and hard-hitting Symposium which will examine: The Nuclear Arms Race, The consequences of Nuclear War, and The Prevention of Nuclear War.
Speakers will include Professor Frank Barnaby and Professor Bernard Fisk from Holland and USA respectively.

Science and Humanities

Science and the humanities are separated to a dangerous degree in universities; but the problem is one many universities recognise and attempt to rectify, according to the Chancellor of Griffith University, Sir Theodor Bray at a graduation ceremony in December.
Sir Theodor said he believed firmly that all science students should comprehend human values, but doubted this was so.
“I was surprised, almost shocked at a recent club discussion, town and gown, on in vitro fertilisation, to find that some senior academic scientists were insensitive to, if not contemptuous of, the ethical and moral issues involved,” Sir Theodor said.
“Lack of concern with ethics and morals, the absence of a social conscience, indeed, has in my opinion been the feature of debate on test tube babies and experiments with human embryos.

“Too narrowly specialised graduates risk becoming human and professional cripples in a world characterised by a continuous redefinition and reshaping of jobs.

Science History Society Formed

Three University of Queensland lecturers are calling for members to join the newly formed Queensland Society for the History and Philosophy of Science.
They are history lecturers Dr Paul Crooke and Mr Mac Hamilton, and chemistry lecturer Dr Barry Chiswell, who have collaborated for the last four years to teach undergraduate and postgraduate courses in the history of western science.
Dr Chiswell said interest in these courses had prompted the decision to form a society for people interested in the subject.
At this stage we don’t envisage regular meetings or membership fees, and members will probably only receive the odd newsletter for a while.”
Those interested in joining the Society can send their names and work addresses to Dr Chiswell at the University’s Department of Chemistry, and they will be placed on the Society’s mailing list.

Bureau of Meteorology

This year the Bureau of Meteorology celebrates 75 years as Australia’s national weather service.
The Bureau began operations on 1 January 1908 and issued the first weather forecasts for all capital cities and regions on the same day.
The national head office, chosen for the new Commonwealth Bureau of Meteorology, was a Victorian-style residence in Carlton, Melbourne, formerly occupied by a Mrs Snowball. It was named, appropriately, “Frosley”.
From the Bureau’s current Head Office in Melbourne, computerised forecasts and warnings got to regional offices in every capital city where the important daily forecasting work is done. Public weather forecasts are issued twice daily and updated immediately if conditions change. Charts and maps are prepared for use by television stations and the press. Detailed statements go to radio stations.
Observers in the field provide daily records of temperature, humidity and wind movement; weather balloons are launched and tracked by radar; some 7000 part-time observers supply rain-gauge and river height readings.
Weather offices at major airports provide up-to-date information for pilots — and this contributes to the comfort and safety of passengers and to the economics of air services. (Flying into a headwind may require additional aviation fuel and a reduction in pay-load. A change of flight path may avoid adverse weather conditions and save both lives and money).
At sea, fishermen keep their radios tuned to weather report frequencies for news of sudden squalls and high seas, and some make sea air temperature and humidity observations for the Bureau.
In the 75 years since the Bureau of Meteorology was established, the need for weather information has grown.

Early history

From the earliest days of white settlement, enthusiastic individuals kept notes on Australia’s weather.

In 1788, Lieutenant William Dawes of the Royal Marines set up a wood-and-canvas observatory near Sydney (Dawes Point) to make weather observations.

When he returned to England three years later, the observatory was allowed to fall into disrepair. Governor Phillip and others also kept some records, and these form part of the Bureau’s climatological data bank.

In the early 1800s more useful information was obtained as the result of exploration by people such as Oxley, Mitchell, Lawson and Wentworth.

In 1821 the governor of New South Wales, Sir Thomas Brisbane, established an observatory at Parramatta.

Melbourne’s first observatory was built at Williamstown in 1854. In South Australia, where rainfall records had been kept since 1839, Sir Charles Todd was appointed director of the Adelaide Observatory in 1855. He built the Adelaide-Darwin telegraph in 1872, and used the new means of communication to transmit meteorological information which he trained his telegraph operators to collect.

In Western Australia an observatory was built under the direction of the Surveyor-General, Sir Malcolm Fraser.

In October 1840, the Royal Society, London, established the Ross Bank Observatory in Hobart. In the north of Australia observations were being made at Port Essington in 1834 and regular daily weather observations began at Port Darwin in 1869.

By the mid-19th century, all Australian colonies had appointed official astronomers or meteorologists who produced daily weather information.

Perhaps the most colourful and perceptive of these was Professor Clement Wragge, Government Meteorologist in Queensland from 1887 until 1902. One of the first to give proper names to cyclones, he sometimes used the names of politicians who annoyed him, equating their behaviour with that of the cyclone, using such phrases as “whooping around and making a nuisance of itself as usual”.

After a prolonged drought Wragge persuaded the Government to let him use special guns in an attempt to make it rain. In September 1902 he set up the ‘Stieber-vortex’ guns around Charleville and, on the 26th day, they were fired at the clouds at one-minute intervals. The experiment failed, and pressure of opinion forced him to resign.

Establishment of Bureau

In 1876 the Commonwealth Parliament legislated to create a national meteorological organisation. The new Commonwealth Bureau of Meteorology began operations on 1 January 1908 with Mr A.H. Hunt from New South Wales as Commonwealth Meteorologist.

A significant expansion of data collecting began in the 1920s. In 1921 upper-wind observations started, using pilot balloons and theodolites; aviation forecasting began, and a meteorological station was built on Willis Island in the Coral Sea to enable early warning of cyclones off the Queensland coast.

In 1924 came wireless, and weather sessions were included in the new broadcasting programs.

In October 1934 a meteorological office was established in Darwin to provide weather information for pilots in the London — Melbourne centenary air race.

In World War II the Bureau provided meteorological services to the armed forces in the South West Pacific region.

Out of the war came radar, which proved to be a valuable tool for meteorologists in peace time, helping to track approaching heavy rain-storms and cyclones.

In 1950 Australia became a member of the United Nations World Meteorological Organisation. In 1954 continuous meteorological observations began at Mawson Station in the Antarctic. Automatic weather stations were being introduced into remote areas by 1962, and the first pictures from space satellites came through in 1964. Only after a Japanese geostationary satellite was launched in 1978 were suitable pictures received on a regular basis in Australia.

Computers were introduced into the Bureau in 1968 to handle the increasing flow of data. New-generation computer systems took over in 1982 to speed access to data and stored climatological records, improve communications, and provide for development in advanced numerical models.

In 75 years the Bureau of Meteorology has built up valuable research material. It is from this data, combined with current information produced with the help of new technology, that harmful weather conditions are discovered earlier, their behaviour is anticipated and their effect upon the community and economy measured.

But, as the Director of Meteorology, Dr John Zillman, says: “The atmosphere is a temperamental and fickle creature with a mind of its own. Just when you think you have it pinned down, it is likely to slide or jump...”

He asks us to remember that the turbulent conditions we experience are weather system eddies in the global circulation "busily transferring heat from the tropics to the pole and helping to ward off the next ice age."
Conferences and Meetings

1983
August 15-18 14th International Symposium on Shock Tubes and Waves
August 22-26 7th Australian Symposium on Analytical Chemistry, Adelaide
Symposium Sec.: AMDEL, P.O. Box 114, Eastwood, SA 5063
Aug 22-Sep 3 18th Int. Cosmic Ray Conference, Bangalore, India
Sec.: 18th ICRRC, Tata Institute, Homi Bhabha Rd, Bombay, 400005 India
Aug 29-Sep 2 3rd International Laser Conference, Melbourne
Dr. R.C. Tobin, Department of Physics, Monash University, Clayton, 3168.

1984
Feb 7-10 8th Solid State Meeting, Pakata, NZ
Dr. J.L. Tallon, DSIR PEL, Lower Hutt, NZ.
Dr. E.J. Frazer, CSIRO Divn. of Mineral Chemistry, P.O. Box 124, Port Melbourne 3207
June 4-5 World Conference on Thermal Analysis Amsterdam
Dr. V.M. Bhatnagar, Alena Enterprises of Canada, P.O. Box 1779, Cornwall, Ont. K6H 5V7, Canada
August 9-18 XIII Congress and General Assembly, Int. Union of Crystallography, Hamburg
Gesellschaft Deutscher Chemiker Abteilung Tagungen Postfach 900490, D-6000 Frankfurt/Main 90 FRG
Aug 15-17 ICOA Conference, “Information Processing in Optics”, Christchurch, NZ
Prof. R.H.T. Bates, Department of Electrical Engineering, University of Canterbury,
Christchurch 1, NZ.

SOLAR WORLD CONGRESS
PERTH 1983
International Solar Energy Society

August 14-19, 1983
Perth, Western Australia

Every two years the International Solar Energy Society (ISES) sponsors and organises a major world forum of particular interest to solar energy researchers, designers and manufacturers.

The 1983 Solar World Congress consisting of a conference and exhibition, will take place in Perth, Western Australia, from August 14-19, 1983. It will focus entirely on the technical, economic and sociological aspects of the provision and use of renewable energy in its many forms and will attract the world’s foremost authorities on renewable energy.

The technical programme will feature six major subject areas including thermal applications in building and industry, electricity/mechanical work, materials/chemical/biological systems, resources/wind energy systems and several non-technical issues.

Topics will be covered by guest speakers, review papers, poster papers and workshop sessions. Abstracts of all accepted contributions will be made available at the Congress, and full texts will be published in Congress proceedings.

Pre and post conference tours, social and partners’ programmes will be available.

Registration fees will be:
$3170 (ISES members);
$3620 (non-ISES members);
$3170 (students - ISES members);
$3590 (students - non-ISES members);
$3175 (guests).

The conference will be complemented by an International Solar Energy Exhibition which promises to be the largest and most exciting ever staged in the Southern Hemisphere.

REGISTER NOW.

For further information contact Barry Wood, Congress Co-ordinator, Solar World Congress Perth 1983, P.O. Box X2278, Perth W.A. 6001, Australia.