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ORBIT

The Journal of the Rutherford High Energy Laboratory

The Case for a University Site at Harwell

The following article appeared on the Universities page of "The Observer" on 21st January and is reproduced here by kind permission of "The Observer".

The proposal that some new universities should be based on existing Government research establishments such as Harwell is one of the most compelling ideas to be put up to the Robbins Committee on Higher Education. Dr. B. V. Bowden, Principal of Manchester College of Science and Technology, devoted the whole of his oral evidence to this theme. Professor N. F. Mott, Master of Gonville and Caius, Cambridge, also pressed the idea. And it seems to be popular with scientists in discussions in senior common rooms.

In a nutshell, the case rests on the need for combining research with teaching - a need which Lord Hailsham, the Minister for Science, seems already to have recognised in principle.

Reciprocal benefits

The five Government research establishments (at Harwell, Teddington, Farnborough, Malvern and East Kilbride) do most of the research and development work in the country not undertaken by industry. The universities, without the resources of either, largely confine themselves to fundamental research. So Government research scientists are prevented from playing their part in teaching. Conversely, university scientists are, in general, unable to make use of the wealth of equipment in Government research establishments.

This system is unique to this country. In America, the Atomic Energy Commission undertakes very little research of its own. Most of it is organised by, and through, the universities. It has now been recognised by the American Government that it is uneconomic to set up independent teaching and research institutions.

Oddly enough, it is on the grounds of economy that the case for a university at a cathedral town

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THE CASE FOR A UNIVERSITY SITE AT HARWELL - (cont'd)

like York, or a seaside town like Brighton, is usually argued. Their attraction is the number of lodgings vacant during the winter. It certainly looks cheaper from the University Grants Committee's point of view to designate such delectable towns as the sites for universities. But, if there is to be much science at a university, the savings on halls of residence may be more than outweighed by the cost of duplicating scientific facilities.

Like wasps to jam

The waste of human resources seems even more disturbing than the waste of money. Scientists are attracted to the best equipment like wasps to jam, and the Government research establishments have captured some of the most able produced by the universities.

As well as a university based on Harwell, there might one day be a University of Leatherhead. The case for this type of university has also been pressed on the Robbins Committee by Professor Mott. University and industry would enjoy the same sort of reciprocal benefits. At present, many industrial centres have no university within miles.

The University

Dr. Bowden, Principal of Manchester College of Science and Technology, examines the proposal from the University point of view. He states his opinion on the need for increased availability of Higher Education and the advantage in centring much of the expansion on Research Establishments. Most of the article appeared in the New Scientist on 5th January, 1961.

A recent statistical survey has shown that the British economy is expanding more slowly than that of most other European countries. On the assumption that the gross national product per head was 100 in 1950, Western Germany had reached 171, the OEEC countries averaged 139 and the United Kingdom only 122; and this despite the fact that the proportional rate of investment per worker in this country has been quite high during the last decade. It is clear that our investment has not been as productive as it should have been; I believe this may well be due to the inadequacies of our educational system.

At long last the Government seems to have taken fright and Professor Lord Robbins's Committee is studying "full-time higher education in Great Britain in the light of national needs."

One can form some estimate of the importance which a country attaches to education by the amount of money it spends on it. Obviously this is an imprecise yardstick, but it can be used in a preliminary survey. Why is it, for example, that we spend nearly twice as much on defence as we do on education, whereas the Russians spend about as much education as they do on defence - perhaps sixteen times as much as we do? Why did we spend no more on our universities than we did on the egg subsidy in 1957 - perhaps half as much as we spent on atomic energy in Harwell and its associated laboratories?

I do not see how anyone can deny that far too many of our young people leave school and stop learning much too early in life. Comparisons between countries are often misleading, because universities differ in size and function from country to country, and standards differ from place to place even in the same country. Nevertheless, however, much allowance one makes, one is forced to conclude that the number of twenty-year-old full-time students is proportionally much less in England than it is in most Western countries.

In America

American universities usually seem to be more clearly aware of their place in society and accept their obligations to the community more willingly than ours do.

About 40 per cent of English children survive in school to the age of 16. About eleven per cent go to sixth forms and six per cent go to university. In the United States almost all children stay at school until they are 18 years old and 35 per cent went to universities last year. Our university population is about 100,000 theirs about 3,000,000; ours has doubled since 1930 and so has theirs; ours is likely to rise to 150,000 during the next ten years and theirs to 7,000,000.

There are about 1,840 universities and colleges in America; perhaps 100 of them can be described as universities in the sense that we use the word in England. There has always been a great difference between the best and the worst of American universities. I believe that the best of theirs are very much like the best of ours.

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THE UNIVERSITY - (cont'd)

Unfortunately many Englishmen who have seen some of the less distinguished American universities have blandly asserted that our own standards are so much better that we need not be worried by our much smaller numbers. This argument simply will not do any longer. The Americans try to give their elite as good an opportunity as we give ours, but in addition they try to give a much better opportunity than we do to a much larger proportion of their population. An average English workman produces less than half as much as an American. Is it possible that American educational system has helped to improve the productivity of American industry?

Figures compiled by UNESCO in 1957 suggest that our number of university students per million of the population is the smallest in Europe. A few of these figures for comparison are,

	No. of students in universities	Population	No. per million population
U.S.A.	2,918,212	175,000,000	16,670
U.S.S.R.	2,013,565	200,200,000	10,060
Poland	139,244	27,500,000	5,060
Finland	18,765	4,356,000	4,310
U.K.	90,500	49,812,000	1,815

Universities and Research Establishments

The Robbins Committee will have to make proposals for the future development of the advanced teaching of science and engineering, a problem which is tremendously complicated by the competing claims of teaching and research, both of which are essential to healthy university life.

To what extent should the universities be used by the Government as their agents for the organisation of research and development? In this country most research and development is done in Government establishments, such as the Royal Aircraft Establishment in Farnborough, in research associations which are organized by and through the Department of Scientific and Industrial Research, in such places as the Atomic Energy Authority in Harwell, or in industry itself. Universities tend to confine themselves to fundamental research and research schools are relatively small.

The American Government uses universities as agents to administer much of its research programme, and the American Universities have been revolutionized in the last fifteen years by the immense growth of their graduate schools. Massacheusetts Institute of Technology has about 3,000 graduate students; English universities awarded 1,309 higher degrees in science and 466 in technology in 1960. The American Atomic Energy Commission undertakes very little research itself; most of it is organized by, and through, the universities. The University of California administers the laboratories in Los Alamos and the University of Chicago those in Argonne. MIT (which alone has a total budget of about $60 million a year for research and development - more than all the English universities put together) undertakes research for the Government in many fields. America has achieved a most intimate association between the universities, contemporary research and industry, to the enormous benefit of all concerned.

On the Continent a very different organizational process produces a similar intimate intermingling between research and development. In Germany the Max Planck Institutes, which are separate from the universities, are very closely associated with them, and senior scientists and engineers are members of staff both of the Max Planck Institutes and of the universities themselves. Furthermore, some of the laboratories which in England would be organized by Research Associations are situated in the universities and are inextricably mixed up with them. This is true, for example, in Aachen, in Delft and in Stockholm. To give one specific example, the main Swedish research centre for paper and pulp manufacture is on the campus of the Technical University of Stockholm.

In England contacts between universities and large-scale research centres seem to exist only by chance and as a result of the individual efforts of university professors and research workers. I believe that both the universities and the research associations suffer very much from this separation, and I think the Robbins Committee should inquire into the possibility of forging much closer links than now exist between such places as the National Physical Laboratory and London University, between the National Engineering Laboratory in East Kilbride and the University of Glasgow, and between the DSIR establishments and the universities which happen to be near to them. Most important of all, there should be much closer links between universities and industry. I think things are better now than they were. They could be improved even yet. I believe in particular the eminent scientists or engineers who work in research stations and industry should be appointed as part-time professors. One-third of the professors in the new technical university of Eindhoven are Professors Extraordinary, including the chief designer of the local motor car factory and the head of the organization and methods department of Philips Company.

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Overheard on the top corridor -

"I haven't read any scientific journals this month.

I've been working."

THE UNIVERSITY - (cont'd)

The New Universities

If more universities are to be built, I think they should be sited where large Government research stations can sponsor them and help them to grow. A university in York or in Norwich will find it extremely hard to recruit good scientists and engineers unless and until adequate and expensive research facilities have been provided. In either of these very beautiful cities it will be possible for members of the chapter of the local cathedral to take an interest in university affairs - but how much better if a university could be put near Malvern or near Farnborough, so that the vast resources which have been established there over the years, and the very able men who live there, could play a dual role like their contemporaries abroad and be both educators and research workers. The students would become aware of the importance and excitement of fundamental work which is undertaken on a large scale with a sense of urgency and with the best apparatus that money can buy.

To summarize, the Robbins Committee must consider what is to be done for the vast majority of students who now leave school at fifteen. Only one child in eight stays at school until the sixth form. We are at present planning to provide a university education of about 5 per cent of the population in 1970. Is it desirable, is it possible, that we should produce in this country what are effectively full-time educational facilities up to the age of twenty-one or so for perhaps 25 per cent or 30 per cent of the population? Would such a policy materially improve the economic position of the country, or are all contemporary Western Countries wrong in thinking that it does? Alternatively perhaps, are they right in thinking that a university education for a substantial minority is a good thing in itself? We should not be too proud to learn from the practice of our most progressive competitors and model our own policy on theirs.

If a large increase in educational facilities is necessary, how are our schools of science and engineering to be built? Is it possible that university departments can be built or should be built or should be built without a much closer liaison between universities. Government research establishments, and industry? If such an association is necessary, as I believe it to be, how best can it be achieved?

If Lord Robbins can answer these questions satisfactorily and if the Government will then do something, we shall make history.

The Research Establishment

Terry Walsh looks at the proposal from the Research Establishment point of view and discusses how a closely associated University may cure some of the defects he considers inherent in Research Establishments.

To graft a university onto a research establishment as has been suggested in the Bowden Mott submissions to the Robbins Committee, is clearly a difficult and disturbing operation, which can be justified only by real advantages. So far most of the initiative for such developments has come from the universities, for whom clear advantages can be seen, but we must also inquire in what way the research establishments might benefit. For instance, we may ask if there is anything wrong with them as they are, which the proposed development might put right.

Research establishments being human organisations share the general imperfections of humanity, so an inquiry which seeks defects is bound to find some. The present purpose is to identify defects related to our theme which is the Bowden Mott proposals. Within this area we will highlight three defects and examine them briefly in turn.

Premature senility

Premature senility is a paradoxical condition because it is related to growth. Growth is most vigorous in youth and indicates vitality; what has it to do with senility and approaching death? To resolve this paradox we must distinguish between the life derived by an organisation from pursuing its ostensible purpose and the life it posesses simply through being an organisation or, to use a related term, an organism. The ostensible purpose in question is research, which obeys one set of laws, yet the organisational life may obey different and incompatible laws. In contemporary thought the life of organisations has attracted the attention of many critics one of whom is Professor Parkinson. It would be a great mistake to treat Parkinson's Law simply as the theme of an amusing and successful book. It is in fact a devasting satire and its success is largely due to the accuracy with which it strikes its target. The phenomenon which Parkinson satirises is universal as was hinted recently by a Russian visitor to the Laboratory. The essential point of the law of organisational development is that it has no necessary connection whatever with the ostensible purpose of the organisation. There is very little doubt that research establishments exemplify the truth to the full. The only real hope relevant to our theme is that universities are not subject to the law and accompanying premature senility in the same way.

This hope prompts us to ask, for instance, if there is a persistent and depressing myth among senior university staff corresponding to that of the "dying establishment" among some of their counterparts in government research. Do new universities have to spawn newer universities after ten to fifteen years in order to keep their purpose alive? The evidence suggests that they are different; either they are born senile or they possess longevity of a very different order. Perhaps their superiority in this respect is due to their being annually refreshed by the new intake of students. Their life is certainly

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coupled in a measurable way to their purpose. Each year a certain number of new students joins. Each year a related number leaves with the purpose of the university confirmed upon them by a degree which attests their advance of knowledge. It may be that the "beneficial flux" theory in research establishments which advocates fellowships, fixed-term appointments, studentships and the like, springs from a recognition that they should simultaneously nourish themselves and the academic disciplines they serve, in the manner of a university.

Fragmentation

The second defect to be discussed is fragmentation, by which is meant the break-up of research people into various specialisations. First we have the notorious split between scientists and engineers, but among scientists there are on the one hand the cleavage between experimentalists and theorists and on the other the proliferation of sub-disciplines such as nuclear physics, solid-state physics and so on. Recently another distinction has emerged in physics between classical and quantum physicists. All these groups are to a greater or lesser extent mutually incommunicado. Doubtless the increasing volume and complexity of knowledge forces specialisation upon scientists but it exacts its price in isolation and impoverishment of intellectual experience.

What has the university to offer to offset this tendency? First a diversification of skill through developing the art of teaching. But this is also related to the individual's research function, for by teaching a man brings to bear on his subject a different point of view and often an unaccustomed rigour which has a stimulating effect upon his own understanding. Apart from this there is the fact that by directing his energies to the demand for knowledge of a continually renewed student body he is brought into direct relationship with non-specialists. The undergraduate has only just set his foot upon the ladder of specialisation and to that extent is more typical of society. The teaching process builds a structure of understanding upon a base of fundamental ideas and the continual appeal to fundamentals produces an attitude which favours unification rather than fragmentation.

Defective Motivation

Finally we turn to defective motivation which, in any organisation is a most insidious disease, so one must be careful to be fair to the research establishment lest there be an implication that university people form a superior class of human beings. Such a view is completely untenable. Nevertheless it can be argued that the university embodies a concept which is superior to anything comparable in the research establishments. The concept we refer to is in the minds of the sponsoring bodies. The universities in one way or another have always regarded themselves as centres of teaching and learning. They have jealously guarded this image and persuaded others of its truth. For this they have had to pay the price of poverty. The research establishments have never had such a clear and noble image of themselves; at best their image has been introverted and restricted. But far worse than this has been the image of the sponsoring body, the government. The government has in the main conceived the research establishments as complexes of exploitable skill, exploitable to almost any end, so that in some cases the most dubious political or economic undertakings have been laid at the door of science. With such an attitude built into them it is no wonder that their people are tempted to wonder if it is really all worth it. Can one unequivocally condemn the satisfaction of a certain armaments experimentalist who was able to say on retirement that every project of his professional career had turned out to be unfit to use in anger against men?

The case of weapons research is perhaps too likely to arouse confusing emotions but it exemplifies clearly how sensitive to motivation is the pursuit of applied research. If research workers are unable to identify themselves fairly closely with the overall ends of their work then inevitably their motivation suffers. It is not our purpose here to decry the entire motivation of applied research which is often rational and may be ennobling. Nevertheless there could be a great advantage in offsetting the capricious and sometimes destructive elements in its non-scientific side by the long-standing and stable ideal of the university.

On the foregoing criticism of research establishments and the manner in which they might be met by combining them with universities a general observation may be made and it is this. We should not see these proposals as mere expedients to solve certain outstanding administrative problems, but as a radical readjustment to the development of science which is needed now because the correct relationship between science and research has not been appreciated in the past. Science is a most comprehensive cultural phenomenon and can never be adequately treated from a utilitarian standpoint.

We're in Trouble with Birds!

The presence of birds in the Rectifier House does not help towards the smooth operation of the plant.

The pest control section of the Ministry of Agriculture was approached for advice but they could not offer any without knowing what sort of bird was involved. Bird watchers at the Laboratory were concentrating on other buildings, not the Rectifier House, and the Ministry came along in person to identify them.

The birds' days are now numbered.

Personnel News

We would like to welcome back Peter Rowe of P.L.A. Nuclear Physics who returned to the Laboratory on 5th November. Peter suffered a serious motor cycle accident on 21st February and was in hospital for some four months.

Our angling enthusiasts will be interested to hear that Ricky Eaton of the Central Engineering Services Section recently caught a 5½ lb. bronze bream. The fish earned him first prize in the coarse fishing section of the London Evening News competition which is open to anglers throughout Great Britain. He was presented with a Certificate of Merit and a voucher for £5 worth of fishing tackle.

Comings and Goings

G. H. Rees and I. S. K. Gardner join Nimrod R.F.

Miss. J. Brimble, J. C. V. Clarke and L. J. Townsend join Administration.

P. J. Daly and D. A. Smith join P.L.A. Nuclear Physics on Fixed Term Appointments.

F. A. Capocci joins Beam Handling Group.

J. S. Webb joins P.L.A. Accelerator Physics; C. F. Jones and K. Corbridge join P.L.A. Engineering.

E. H. England and G. R. Gascoigne join Central Engineering Services.

K. C. Morris, S. E. Nunn and M. Russell join Nimrod Engineering.

J. Kay and C. S. Thomason have left us.

Suggestion Awards

We would like to congratulate the following, whose suggestions won the awards at the second meeting of the Rutherford Laboratory Suggestion Awards Committee, on 29th October:-

F. J. Welch		£2. 0. 0.
E. B. Iberson		£5. 0. 0.
A. H. Spurway	encouragement award of	£1. 0. 0.
C. E. Webb	encouragement award of	£1. 0. 0.
P. Seager	interim award of	£1. 0. 0.

The Suggestion Awards Committee is meeting again on 3rd December, to consider a number of suggestions recently received.

We are a little disappointed at the relatively small number of suggestions coming in; only 36 have so far been received since 1st April this year. Is it because people are not yet used to the idea of a Suggestions Scheme - or is it perhaps that they are too busy with their work, attending meetings, committees, etc. Whatever the reason, we hope that the trickle will become at least a gentle stream in the future.

Remember that 1965 is National Productivity Year and that Suggestion Schemes are concerned with productivity in its widest sense. It would be nice if we too could play our part in promoting efficiency through the medium of our Suggestions Scheme.

C. J. E. MACDONALD

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The following letter was issued from Personnel Branch on 13th November,

Dear Mr. S ----------

With reference to your recent application for employment as a Toilet Attendant, I regret to inform you that there are no vacancies for employees in this capacity and I must point out to you that our advertisement in the 'Oxford Mail' was for a Laboratory Attendant.

Yours sincerely,

EDITORIAL

This issue has given considerable space to discussion of the need for greater availability of Higher Education and in particular the proposal to site Universities at Research Establishments. It may seem of little direct relevance to working at the Rutherford Laboratory.

How it indirectly affects us is obvious enough. The material standard of living achieved in a country is dependant on the way the various resources of the country are used and it is certain that this is greatly influenced by the extent and level of education in the country. In many cases the 'backward' countries are backward not for lack of resources, in terms of natural wealth and manpower, but because they lack the trained men to exploit these resources. This is the materialistic approach - educate the scientists, administrators etc. ... and up goes the standard of living. Dr. Bowdens comparisons with America are strong indications of this. But there is also the less tangible, but maybe more important, aspect of education (and here we use the word education in its broadest sense - not in the sense of vocational training). It can enrich the feelings and imaginations of those who receive it, making life for them a richer and more exciting experience. And this is an effect spreading gradually throughout society as one 'enriched' life impinges on another.

However it would be difficult to persuade our Government to subscribe millions to the end of nourishing the Nations culture - the line of approach must be the resulting material progress. Can the Government be persuaded that our slow rate of progress in comparison with the other advanced Nations is in large measure due to insufficient support for Higher Education? The demand for this education within the country is increasing - thousands are turned away from our Universities every year (one quarter of those qualified in the present University year). It is estimated that in 1970, 40,000 young people who have the necessary qualifications will be unable to find a place in University. It is worth a thought that our own children may be among them.

These are some indirect effects but the issue affects us directly also. We already have very close ties with the Universities. All the projects of the National Institute for Research in Nuclear Science so far involve intimate cooperation with Universities and may be said to provide facilities for nuclear research which an individual University could not afford. We have therefore an immediate interest in the development of our University system. Their expansion could affect the demand on the National Institute to provide more facilities. A change in their nature could change their relationship with the National Institute. And if the proposal to site a University at a Research Establishment is taken up - where better to put this into effect than at a National Institute research centre.

The future of the N.I.R.N.S. may well be greatly influenced by what the Robbins Committee of Higher Education reports in 1963.

We should make it clear that the emphasis we have given to the Bowden-Mott proposals and the development of this theme in the articles and the Ecitorial are not a statement of official National Institute policy. They are perscnal opinions on this issue and if conflicting opinions are presented to us they will find their way into our pages. Suffice it that we have raised the issue and made positive comment on it.

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Letters to the Editor

Letters may be addressed to 'The Editor, ORBIT, Building R.1'. Pseudcnyms are accepted provided the autors name is known to the Editor.

Sir,

May I congratulate Mr. Ken Smith on his enjoyable article in your last issue. A man with conviction enough to become a Lay Reader must state his case and it may seem churlish to take issue with this when he has obviously tried not to make it too obtrusive. However I feel that in a research establishment, if anywhere, all topics should be subject to questioning. The point at issue in reference to "----- the immense common ground between the scientific search for fact and the Christian discovery of Truth". In my opinion there is very little common ground between Science and Christianity.

Science is concerned with Nature - to search out the facts of Nature and assemble them into some pattern. This Science does by investigating Nature and assembling the results into as coherent and concise a pattern as can be worked out. (Sometimes of course, theory has preceeded experiment - this is no deviation from the normal course of Science. I would however say that a pattern or hypothesis about Nature which is not susceptible in some of its elements to investigation is not in the mainstream of Science, though it may well be a fine intellectual exercise). It is true that the pattern Science reads into Nature may be far divorced from that presented by our immediate senses but that does not make the pattern in anyway 'Supernatural'.

Science advances by the discovery of new facts about nature or by reorientating facts already assembled, proving and disproving facets of the prevailing pattern. One essential feature of all its theories is that they will be modified, or possibly completely discarded, if contradictory evidence comes to light. Theories will then be developed to absorb the previous knowledge and the new discoveries.

For the purpose of this letter I want to stress that (a) Science is concerned with Nature, (b) The

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method of Science is to investigate Nature, (c) The theories of Science are not dogmatic but can and will be changed if future evidence demands it.

Christianity, fundamentally, is concerned with the Supernatural. Its basic premises, on which the whole structure of the Christian Faith is built are about things beyond Nature. These supernatural facts are claimed to be Divinely revealed and Christianity which might be said to relate our behaviour in Nature to the Supernatural has its roots in the Divinely revealed pattern of the Supernatural.

Christianity does not investigate the Supernatural in order to discover the facts about it and to read patterns into it. They have been revealed. The Supernatural is not amenable to proof or disproof and the pattern which prevails today admits no possibility of error - it will not be modified or discarded tomorrow. This is perfectly logical for, since there can be no investigation of the Supernatural there can be no evidence (which would need to be Supernatural) to contradict the prevailing Christian theories.

The parallel points to those I drew from discussing Science are that (a) Christianity is concerned with the Supernatural, (b) Christianity does not investigate the Supernatural but recounts the pattern Divinely revealed, (c) The Christian pattern of the Supernatural is dogmatic and not susceptible to change.

In attemptying to analyse both disciplines I have obviously had to be rather clinical. Many of the influences on development, many of the facets of their separate natures have been omitted and, above all, there has been no space to illustrate that each involves human beings and is capable of generating all the fire and excitement and satisfaction of any of the other responses of man to his environment.

Perhaps an example will help to clarify my thoughts. Consider the statement of Christianity "There are three Persons in one God : Each Person is God but there is only one God". This has the three characteristics above - it is concerned with the Supernatural; it is arrived at not by investigation but by revelation; it is a dogmatic pronouncement not susceptible to change. It can be said in complete confidence for it cannot be investigated and shown to be right or wrong. It could just as sensibly speak of four persons in one God without being open to contradiction had this been revelation.

If an equivalent statement were made in Science (say "There are three A in one B : Each A is B but there is only one B") it would concern something in Nature and could be investigated and stand or fall by the result of the investigation. The source of the statement is quite irrelevent, whether it is the most elegant theory, it would stand or fall by the investigation. Revelation carries no prestige whatsoever. In Science of course such a statement seems ludicrous but this does not mean to say that it is ludicrous in Christianity, for, if it is about the Supernatural, why should the laws of Nature apply? And this is the point I have laboured so long to say clearly - the rules and regulations of one do not carry over into the other. When a Scientist accepts such a proposition he deliberately does not bring his scientific criteria of judgment to bear.

Now I have spelled out to my own satisfaction that there is not "immense common ground between the scientific search for fact and the Christian discovery of Truth". The two systems are radically different - different in their spheres of interest, in their techniques and in the nature of the pattern they produce. In my opinion they can co-exist today only because they are treated as different disciplines and the rules of one are not carried over into the other.

It should be noted that I have not said at any stage of the discussion that one discipline is 'false' or in some other way dubious. I obviously have my opinion on this but it is not the purpose of this letter to develope it, I only wish to remove the suggestion of 'immense common ground'.

HUMANIST

Sir,

Your remarkable journal would seem largely devoted to problems of profound philosophical and metaphysical significance: I venture, therefore, to beg the freedom of your columns for the purpose of provoking discussion upon the following enigma, viz,: 'Have we, as Physicists, the right to separate K-mesons?'

Some of your lay readers may not fully appreciate the far-reaching inwardness of the question, and may not even be aware of the fundamental difference between the K- and the Wroe- meson. Some amongst them may even be so rank as to file your splendid publication in the well-known receptacle, and trouble their p-brains no more about it. Sir, that is not the way to advance Physics, indeed it is not! Therefore, I insist, it is our Duty to give such minds as we possess to this Problem of Our Time.

Consequent upon our having Built an Accelerator, (no matter why), we shall be subjected to moral pressure to separate these unfortunate particles, - to take upon ourselves, Sir, the functions of Bessel, Gauss, God, Hill and Mathieu(1). Envisaged, if you will, these innocent entities we will have Created, perhaps misguidedly, fleeing before the Wrath of Man, in company with their beaming little consorts the π's, - until the decree nisi of electromagnetic separation overtakes them; many of them to decay forthwith in heartrending circumstances.

What microscopic tears(2) may be shed; what plaintive cries(3) may be heard; what anguish(4) may be discerned, in their sub-atomic universe? Scoffers may ye be, can ye be really sure(5) that such is not the case?

I rely, Sir, in all optimism, upon the wisdom of your contributors to throw some light upon this, our dilemma.

SIGMA PSIBAR, Ph.D.(6)

(1) In alphabetical order.
(2) ψ- drops. (3) μ's. (4) Ξ's.
(5) And if so, or if not so, what is really meant by really sure, anyway, if anything.
(6) University College of Ballygomartin; awarded for gallantry in the face of scepticism.

LETTERS TO THE EDITOR - (cont'd)

Sir,

A correspondent in the October Issue of ORBIT divides the people who work at NIRNS into Scientists, Administrators and Engineers. What I should like to know is, 'What about the Workers?'.

JACK

Sir,

Who is this GADERENE swine?

MEPHISTO

Who the devil is MEPHISTO? Editor

Outside Hours

Two Men in Two Boats

Continuing the series of articles on outside hours activities opened by Ken Smith in our last issue, Harold Wroe describes how he and Terry Walsh get away from it all.

Watched by his eldest son, H put his canoe on the roof rack and loaded his kit into the boot of his car one bright, cold autumn morning. "Are you going to capsize Dad?" asked the son.

Ignoring the question which had been posed at least ten times, H said goodbye to a tearful younger son and drove off to T's house at Abingdon, bent on getting away from it all for a day. They put up T's boat and H made a rapid mental equipment check - dry clothes in waterproof bag, tennis shoes, seat and backrest, repair kit, tin of soup with tinopener, petrol stove, pan and spoon, spray deck, painters oil-skin.

Then they drove back to Wallingford to fetch H's paddles which he had forgotten, with a parting shot from Mrs. T, "I don't want to worry you, but you are obviously unconsciously reacting against the whole thing".

Then they drove back to Abingdon with a parting shot from Mrs. H, "You are not going to drive all that way back are you? You must be mad". Smarting under these twin broadsides H & T said coldly, "We want to do the upper Thames and we shall".

An hour later they were putting their boats in just above St. Johns lock, after a friendly keeper had waived the lock fee because they were not really going "through, by or over". "What is it about Thames lock-keepers that makes them such pleasant chaps?" said H, thinking of the bad-tempered types on some canals in North of England. Perhaps actually having a licence had something to do with it, but probably it was the fact that the Thames is a pleasure river and anyone they meet is relaxed and enjoying themselves - or trying to.

This was hard to believe looking round at the anglers posted like sentries at regular 20 yard intervals along both banks. T thinks that angling is a form of psychoanalysis, "It requires long periods of solitude and close attention to what goes on below the surface. That's why they react strongly to canoeists - we're disturbing their unconscious minds", he said. He's something of a psychologist. There they were, overcoated, gum-booted, mufflered, gloved and capped; anybody would think there was something odd about a chap dressed in anorack, shorts, tennis shoes and football stockings.

They paddled up past the picturesque Halfpenny Bridge and the moorings for the New Inn where T made an unsuccessful attempt to get a bottle of bear for lunch. Just above the bridge they came to the cruiser station, the last on the

(cont'd overleaf)

TEASE

When referring to clocks then we all must agree

that $T = 2\pi\sqrt{\frac{L}{g}}$

More simple, however, is the general case when

T also = $\frac{2\pi r}{N}$

With uniform speed it is easy to see

that T (when in seconds) is $\frac{S}{V}$

All this you may say is one hot enigma

when $T^4 = \frac{E}{\sigma}$

Under stress you might find other values as well

for T also = $\frac{\lambda X}{L}$

Give in I advise with no more ado

for T = $\frac{Rh\sigma g}{2}$

The proofs are a fiddle, but couldn't be neater,

and T is a twist when it = $K\theta$

And scientists whether from near or afar

will all say T = $\frac{PV}{R}$

With all this behind us, small wonder that we

have become, as a nation, great drinkers of tea.

A.R.M.

TWO MEN IN TWO BOATS - (cont'd)

Thames, with the boats bright in the autumn sunlight. "What decides the name of a boat?" said H, looking at a fibre glass launch with a large outboard engine under a polythene cover; the name was "Pacemaker". "That engine is big enough to exceed the Thames speed limit by a factor three. Something of a status symbol" said H, who sees status symbols everywhere and had never been able to think of a name for his own boat.

Further on was the Round House and the junction with the old Thames and Severn Canal, now sadly derelict and overgrown with weeds. The river was changing width rapidly and became very shallow in places, so that their paddles touched the gravelly bottom frequently. The banks became high and finding a landing place for lunch was tricky, H making an undignified exit up a slippery mud bank, while T, having successfully landed, remembered his lunch tin in the back of his boat and nearly fell in trying to get it. In view of the weather H had decided to bring soup for lunch and now got out his lightweight petrol stove in an attempt to heat it up. "I don't usually have any trouble with this", he lied, "but I've had to put a homemade jet in it and the hole is a bit too big". He warmed the stove in his hands in the approved manner and after a long time a few miserable drops of petrol appeared through the jet. On igniting these they suddenly turned into a flood so that the whole stove was enveloped in blazing petrol before H could find the key to work the shut off valve. When he shut the valve the blaze ceased and a small weak flame was all that remained. "It wants pricking", said H knowledgably and got down on his hands and knees in the long grass and high wind trying to poke a ten thou. wire down a fifteen thou. hole. This seemed to work because the fitful belching of the stove gradually increased in intensity and frequency till it was roaring like a blow lamp, only occasionally coughing out a large yellow flame and clouds of black sooty smoke. T had brought cold chicken so they decided on a combined lunch and put the chicken in the vegetable soup, which made an unusual sort of broth.

Afterwards they went through the ritual of emptying the water out of H's boat. T's canoe is rigid and watertight, but H has a collapsible with an unorthodix skin material. This is nylon cloth with a thin PVC film on both sides and the man who sold it to H praised its lightness and immense strength. Unfortunately it wasn't waterproof. After some futile attempts to cure this H had simply raised the seat an inch to prevent his backside getting wet and resigned himself to emptying the boat halfway through each trip. Fortunately he had included in the design a drain hole on the deck which enabled the last drop of water to be got out (and also enabled his younger son to get in a complete set of BA box spanners which now rattled about like marbles in a tin every time the boat was tipped up).

In the afternoon they pressed on up the ever narrowing Thames and came to some mild rapids and shallows. After scraping and bumping up a few of these with aching back and shoulders they decided that it was too much like hard work (T and H are quick to insist that they only canoe for pleasure) and turned back downstream. The advantage of the current was offset by the wind, which T hates, so that the return run was passed in grim silence, in contrast to lively philosophical discussion of earlier in the day. The bright autumn sunshine and blue sky had brought out one or two people in hired launches and they passed by with uncertain smiles from both parties.

"We're a funny lot aren't we?" said T, "why don't we pass the time of day with each other like sane human beings?" It reminded H of the story of the two Englishmen who met in the middle of a trackless dessert, but because they had not been introduced, passed by without a word.

The final beat down to St. Johns lock was strenuous, with the wind blowing hard across the water meadows and they were thankful to reach the shelter of the lock-keepers house. A pot of tea and a mince pie at a café in Lechlade finished off the trip and produced a suitable satisfied feeling. When H returned home he was greeted by his eldest son, his face shining with gleeful anticipation. "Did you capsize Dad?" he said.

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WHITLEY COUNCIL STANDING COMMITTEE

"The Staff Side said that they understood that, despite an agreement that machines were only supplementary to the trolley service, a decision had been taken not to extend tea trolley service to new office blocks. The Official Side replied that a formal decision had not been taken in this matter but that it was unlikely that staff would be available to extend tea trolley service to such office blocks."

"The Chairman said that the sum of £25 had been paid from Institute Funds into the Mayor of Abingdon's Appeal."

"The Official Side said that they were becoming more and more concerned about the security of property on the site and particularly about the fact that strangers were free to enter and move around the site at will. They were considering the introduction of arrangements to encourage strangers to report to the Gatekeeper and these arrangements might involve the identification by means of a badge or sticker of the cars of members of the staff."

Extracts from the Minutes of the
4th Meeting, 29th October

A Day to Remember

Ralph Thomas

When one speaks of a "day" at CERN it usually means, for a visitor anyway, the period which elapses between leaving one's hotel bed and returning to it. This often tends to have no bearing on what the sun or moon happen to be doing at the time as I hope the following description will show.

We had arrived at CERN knowing that our experiment would be done, but no one was quite certain when and we had to wait for the scheduling meeting held every Friday morning at 8.30 a.m. which decides the time allocation of the Proton Synchrotron for the following week. We were "on" at 9 a.m. Thursday next and could make plans accordingly. A half-hearted attempt was made to draw up a schedule of shifts with old-timers muttering grimly that they "intended to see the thing through to a finish - come what may!"

At least the "day" began at a reasonable hour this time. (Despite the scheduling meeting our starting time had in fact been pushed on until 10 a.m. only the day before). At breakfast the question on all lips was "how will the machine work today?" As luck would have it, or perhaps as some would say, by the operation of a fundamental law of nature, the weather was perfect. For the first time since our arrival in CERN we could see the Jura, which had been shrouded in mist, and, as we drove down the Route de Meyrin, the morning sun was shining pink on the new snow. Looking behind us we were even more sorely tempted by the Alps, with Mont Blanc making one of its infrequent appearances.

Within half an hour of arrival I noticed a red-faced, shirt-sleeved John MacEwan cursing heartily (or declaiming in Gaelic, I'm not sure which) behind the racks of electronics in the counting room. He had tried six mains plugs before finding one with power on it! This, on top of a struggle to understand the cable routing from experimental hall to control room, had led to this temporary lapse from his usually calm and unruffled exterior. Electronics having been checked the beam experts settled down to wait for 10 a.m. which soon arrived, and passed with ominous warning that a generator had failed but they "were working on it". There was nothing to do but wait; we took the opportunity to have a quick coffee and eat some of the excellent sticky buns which are sold by itinerant girls pushing trolleys around the Proton Synchrotron building. The coffee, by the way, is the genuine article, a large cup costing 8d., and is very welcome.

At 11.30 we were given the machine and set to work to optimise our beam. There was some apprehension about this as we were not certain how the machine and target would work at 10 GeV. We were quickly relived to find that our earlier estimates were somewhat pessimistic and that our intensity was higher than expected. Bending magnet and quadrupole lens currents had been calculated prior to the run and were found to be accurate. During these measurements we were able to note a jitter in machine energy of a few per cent due to sticking of the target mechanism. This was quickly rectified by the machine operator.

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Meeting of the CERN Council

The CERN Council with representatives from the 13 Member States (Austria, Belgium, France, Germany, Greece, Italy, Norway, Netherlands, Spain, Sweden, Switzerland and the United Kingdom) with observers from Turkey and Yugoslavia, met on 12th October.

They approved a proposed rate of growth for CERN of 10 to 14% per year.

Professor Powell, from the United Kingdom, who is President of the Scientific Policy Committee said, "The judgement and aspiration of those who founded CERN have been most brilliantly vindicated. Every month brings important discoveries ... and there can be hardly any doubt that in the next decade this process will continue and ... bring radical changes in our understanding of matter and in our basic conception of it. Through the development of CERN, Europe has to make very valuable contributions to these developments. In all the Member States, physicists see CERN as their chief place of experiment ... and sometimes forego equipment and resources in order that CERN can be better supported. The Scientific Policy Committee concludes that CERN plays an indispensable part in the development of European physics and that this institution can have a brilliant future".

The Director General of CERN, Professor Weisskopf, thanking Member States for their support said, "The recent Conference on High energy physics has shown that CERN now plays a leading role in this field. Our policy has been to do here the best experiments and to make ourselves available to a growing number of visiting scientists. A result of this is the ebbing, and even reversing, of the flow of European physicists going to work in the United States. However, probing the secrets of the fundamental aspects of the universe will become harder and harder and this will require an appropriate rate of increase in resources".

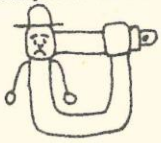
A DAY TO REMEMBER - (cont'd)

Leaving the beam experts to get on with it those of us not directly involved snatched a quick lunch in the canteen. Perhaps the visitor is struck most by the "fundamental democracy" of the CERN Canteen. It is quite possible you will sit next to the Director General at lunch and all the senior staff eat with the "rank and file". CERN staff tend to criticise their canteen rather harshly but we found the food in general very good, a two course meal with wine or beer costing around 3.50 Swiss francs(about 6s.). When one takes into account the difference in cost of living, this appears to be really good value. I was particularly fond of the yogurt flavoured with fruit costing 50 centimes.

At 2 p.m. we were handed the beam and set to work loading our emulsions into the steel assembly built for our experiment. We should have some rather amusing photographs of physicists climbing over concrete blocks in some of the most undignified postures imaginable. As the word got around that we were "on" the counting room began to fill up with most of the experimental team. Soon it was rather like Selfridges on Seles Day with the exception that here one had to be trilingual to completely follow the trend of events. Tense count downs were followed by inevitable "Oh blast! Cancel that!" It was galling to see emulsions that had taken hours to prepare being exposed in a matter of minutes. Other users of the machine were becoming more and more frustrated as the machine was switched on and off at short intervals, each time a breathless runner appearing in the counting-room waving an emulsion and gasping "O.K., let's have it back on".

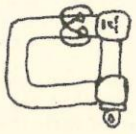
Ode to a Shackle

In preparation for the 'Lifting Equipment Safety Fortnight' this ode has been composed in Safety Section.

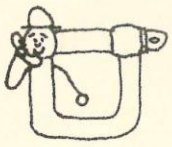


I am only a teeny shackle
That never sees light of day
'Cos someone has mislaid me
And I'm hidden far away

It's ages since I saw someone
And no one looks at me
In fact I'm turning rusty
And I'm weakening steadily



If only you would find me
Before I rust away
And send me in for testing
It would surely make my day



So if YOU come across me
Don't throw me on the floor
Inform the Safety Section
On extension 314

Soon the short irradiations finished and we needed runs of an hour or more. Health physicists then surrounded us in large and alarming numbers armed with ionisation chambers mounted on bamboo canes, plastic scintillator samples and pellets of sulphur. Peter Simpson was busily engaged in hanging large chunks of aluminium in the crevices between the steel plates, which often slipped down with a resounding clatter causing his ingenuity to be taxed to the limit. You'd be surprised what can be used for fishing!

Order was slowly coming to the experiment and we were able to take an evening meal in reasonable calm. As this was to be our last large meal before breakfast we ate all, from a menu completely different from that of midday. Coffee in the lounge afforded a chance to buy a few post cards and write home. The day's newspapers had arrived from home so we stocked for reading material if needed through the night watch.

As the counting room began to empty we planned the night's activities. Some test exposure results were becoming available and we decided to repeat some irradiations, with a larger intensity. In the lab. scanning girls were busy estimating track and star densities in our emulsions; at 11 p.m. we sent them home, with thanks. The repeat short irradiations were completed by 1 a.m. and we bought coffee from the machine installed by the control room. This is absolutely foul, particularly in the early morning, and is a unique mixture of tea, chocolate and black coffee. It made me grateful for the regular servicing of our machines in the Rutherford Lab.

At 4 a.m. a red-eyed Peter Simpson emerged from the health physics counting room where he had been busy with plastic scintillator samples used to measure neutron densities. He joined us in an interesting philosophical discussion about the nuclear cascade in dense matter in which the major protagonists were Herr Geibel from A.L.O. and Dr. Baarli of CERN Health Physics. Someone who tried to lighten the fare with a doubtful joke was promptly "sat on".

As dawn came more coffee was followed by a wash and shave. At 9 a.m. we were able to buy croissants which dispelled the "morning after" feeling. The continental habit of eating breakfast on the job is certainly appealing. At 10 a.m. the experiment finished and we were able to remove all detectors from our assembly.

The rest of the "day" was taken up with completing measurements on the plastic scintillator samples, despatching some irradiated gold, aluminium samples to Bill Burrells at the Rutherford Lab. (which aroused the suspicion of the Swiss-Air man at the airport) and checking test emulsions. At 5 p.m., more than 30 hours after its start, our "day" at CERN finished. Peter Simpson limped into the car estimating that he had walked 20 miles between his lab. and the Proton Synchrotron. Those that had stamina celebrated with an excellent meal in Geneva but most of us mortals went straight to bed!

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Report on Nimrod

Extracts from the paper presented by Mr. Mullett to the Visiting Committee on 25th October

Since the previous report the master programme for the machine has been changed in certain detailed ways, a particular example being the insertion of two one-week periods of powering four octants of the machine to shake down the pole pieces. Despite all these things the general state of the project is as it should be, and August 1963 stands as the date for closing the machine for commissioning.

Injector

Much progress has been made in overcoming troubles with the R.F. power source and in dealing more selectively with the multipactor areas in the tank so as to minimise sparking and conserve R.F. power for beam loading.

After careful work on the ion column and the low-energy drift-space components, currents as high as 10 milliamperes have been achieved at 15 MeV. This is still without the pre-buncher which should give at least a factor of two improvement. The bunching cavity has been fully tested and is now being installed. Components in high energy drift space will be installed soon. The electrostatic inflector has been tested and voltage breakdown limitation has to be overcome.

The 15 MeV beam has been used for a variety of experiments to determine the effect of lost beam on the synchrotron vacuum vessel and other components. Stopper and monitoring devices are now being devised.

Magnet and Power Supply

Magnetic survey was satisfactorily completed on programme. There is much detailed analysis of results to be made but in general the field distribution is good. The remanent field is of the order of 8gauss and averaged over several magnet blocks is uniform around the ring. The median plane error is of the order of 0.1 inches and the average field gradient is well within the range of correction. Good injection conditions have been achieved and flat top for extraction is looking promising. A number of somewhat strange phenomena have required explanation but this is now past history.

The power supply has behaved well during magnetic survey and subsequently the fault has been eliminated from the rectifier equipment which was responsible for the sensitivity of the power supply to asymmetric loads. The ripple filter equipment has been introduced to the circuit and it does more or less what was expected. Some extra measures may have to be taken if the lower frequency ripple voltage cannot be reduced. The power supply has been recently run for a further week to bed down pole pieces after reinstallation with the outer vacuum vessels in place. Our own engineers set up the whole system and the running characteristics were better than ever before.

The second alternator is now installed and it will be run as a separate unit prior to coupling up the whole system.

Vacuum System

The eighth outer vacuum vessel is soon to be installed in the machine. We have had several cases of damage to vessels on installation of pole pieces but successful repairs have been done. Vacuum testing in situ is going well. The first spare outer vessel will arrive soon.

We have six inner vessels; one is installed in the machine and four more are ready. Final dimensions can now be obtained for individual fitting of straight section components, particularly the bellows units.

The first header vessel has continued to give trouble and the best delivery date now foreseen is 5th November. The second header vessel may also arrive in November. We shall complete four header vessels. In the meantime, we have three polythene closure plates and will complete a total of six. We shall have to close one and maybe more octants of the machine with closure plates where we would prefer to have header vessels. It is too early to say whether changeover to headers will be before or after commissioning.

The large scale installation of vacuum pumps will start very soon.

R.F. System

The production R.F. drive unit is now installed. Its "mechanical" state is reasonable but there are some technical difficulties to sort out. All other work is progressing well.

Control System

Design information is now well ahead of

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800 B.C. Finds at Nimrud

The recent discovery of the palace of Shalamaneser III King of Assyria, 859-824 B.C., took place at Nimrud near Mosel in Northern Iraq.

We wish to allay any fears that the National Press had misprinted 'Nimrod' and that the progress of our synchrotron will be further delayed while archeological investigations are completed. Fortunately nothing more exciting than a 200 year old skeleton was unearthed during the Nimrod excavations.

REPORT ON NIMROD - (cont'd)

installation and wiring. Much attention is being given to getting more labour on site and getting access to areas where work has to be done without conflict with other operations.

Bubble Chambers

Preparations for the first cool down of the 1.5 metre liquid hydrogen chamber are now almost completed. A pulsed γ-source for sensitivity measurements has been made and tested.

The compressor for the 1.5 metre heavy liquid bubble chamber is installed and tests will start soon. Window tests are being done on the first sample from Schotts. A satisfactory solution to the problem of porosity of the concrete floor has been found and the whole floor will be treated in the near future.

Design work on the 80 cm. liquid helium bubble chamber is proceeding satisfactorily and tenders for both the refrigerator and the magnet are being considered at present.

The Laboratory now has 6 scanning machines commissioned and these are being used for experiments carried out at CERN in collaboration with Oxford University and University College, London. Measuring is done on the University College machines at present but the Laboratory's own machine should come into use by the end of this year. Design and construction work on the HPD is proceeding satisfactorily. The main mechanical parts are being ordered and some of the electronics, including the buffer store, are already working.

Preparations are being made for monitoring the beams used in bubble chamber experiments using time of flight methods and Cerenkov counters.

Buildings

The extension of the main experimental area to the west side is roofed over and could be finished by the programme date of March 1963, but some necessary changes have to be made to accommodate services for the Helium Bubble Chamber. This area generally is being tidied up notably by removal of the concrete plant which did the major work on the magnet room. The mound behind the main experimental area has been land-scaped into two pleasant hills and the whole is grassed over.

The new heavy laboratory in which we shall be setting up beams equipment has been handed over. The associated office block is nearing completion.

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NIELS BOHR

The Pioneer of our Modern Ideas on the Structure of the Atom

Neils Bohr, natural philosopher and physicist, died at the age of 77 on 18th November. During most of his life he had considerable influence on the philosophical outlook in physics and for many years he was the leading spirit in the development of the modern quantum theory.

At the age of 27, Neils Bohr came to England to work with J. J. Thomson at the Cavendish Laboratory. Shortly afterwards he went to the University of Manchester where Rutherford, in his study of radio-activity, had just established the idea of the nuclear atom. Rutherford's conception of the atom as a small solar system with the electrons circling round like planets was at that time very mysterious; it was not understood why the electrons did not radiate away their energy and collapse in on the nucleus. Bohr saw that Planck's quantum theory of light might account for the stable state of atoms. The theory he developed and applied to the hydrogen atom, was one of the greatest forward leaps in physics, and it astounded the world of physics in 1913. The entire field of meaningless spectroscopic data was suddenly transformed into information that was intelligible in terms of Bohr's ideas of the atom.

In 1920 Bohr was mainly responsible for the formation of an Institute for Theoretical Physics in Copenhagen which offered opportunity and sanctuary in the pre-war years to many of the formost pioneers of quantum theory.

In 1936 Bohr advanced the idea that the nucleus can be compared with a liquid drop, and later it was in Bohr's Institute that Meitner and Frisch in 1937 developed their ideas of nuclear fission. Bohr, like many others, because of Jewish ancestry, fled from Europe and eventually went to the United States in connection with the A-bomb project. During the remaining years of his life he was greatly concerned with the consequences of the fearful weapons which his own work had helped to make possible. He never ceased to appeal, even in the United Nations in 1950, for an 'open world' free from thoughts of war.

E. R. HARRISON

ELECTRON LABORATORY IN WONDERLAND!!

A 45 acre site at Daresbury in Cheshire has been selected for the new Electron Laboratory. The site which the National Institute wishes to develope is at present owned by I.C.I. Ltd.

Daresbury, some 5 miles from Warrington, Lancashire on the A56 Chester road, was the birthplace of 'Lewis Carroll' (Charles Dodgson) whose father was vicar of the parish. A memorial window in the parish church portrays characters from Lewis Carrols famous book "Alice in Wonderland".