

MAINSBRIDGE, Professor Bruce

Saw the Uni. of Tas. change dramatically in late fifties when Federal funding arrived - the whole character of the University changed. Prof. M. is very critical of quality of teaching during his undergraduate period.

Undergraduate 1947-51 approx. Science.

1947 a bumper year for ex-servicemen.

"If you read the Murray Committee Report in retrospect you realise there were doubts about [the quality of courses in] all post-secondary institutions in those days". M. is critical of the quality of Tasuni then. All the universities had taken on far too many students at short notice. Murray did a great deal to pull all universities out of the "post-war mess".

030 J.C. JAGER an international standard scholar but "teaching in general was atrocious - no, thoughtless". i.e. no thought for the students.

035 illust. of new chemistry laboratory and inadequacy of demonstrators.

"1st year chem. clearly taught on the factory lines". The Professor's lectures (Kerr ??) were bad. Illustration of (Professor) Polya's teaching methods; also methods students adopted to pass exams.

070 Students were "not encouraged to complain". [Note: people's experience apparently different from M's]. Criticism of tutorials which followed on from JAGER's brilliant lectures. "No real interaction".

085 The Physics Department had no tutorials "but they were more interested in us. There was a very strong evangelical group PLYMOUTH BRETHERN. F.D. Cruickshank was the leader ... once saw him preaching in the street on a Sunday night, "and nearly passing out with embarrassment".

100 The ex-servicemen did have - through Federal funding - access to tutors that we didn't have.

It didn't impress me as a university - except for JAGER and S.W. CAREY. Tribute to Carey "he ran us over the hills and mountains of Tasmania at the rate of knots", had brilliantly illustrated lectures; had a keen feeling for the physical situation in systems.

[M. introduced Carey for Hon. Doctorate of Papua N.G. University].

Carey revived continental drift theory when he was a young man in New Guinea.

MAINSBRIDGE, Professor Bruce (contd.)

- 120 Cruickshank and the Optical Annexe.
 Q. Was the 3rd year Physics course too specialised on optics?
 A. Perhaps during the war. Details.
- 130 "The Fenton brothers" arrived back in Tasmania. Course reasonably balanced.
 "Very inefficient dissemination of knowledge" in Tasuni at that time. Found it hard to believe this due to increase in numbers to a mere 800. Perhaps the country was suffering from post-war exhaustion.
- 160 Discounts concept of Tasuni as small and isolated. re ORR case: "had the awful feeling that this was the sort of thing that would happen in Tasmania."
 Federal funding made ALL THE DIFFERENCE. Uni. of W.A. had similar problems.
- 180 Involvement - not in politics - but in very active S.C.M. Vice-President of Christ College in last year. There were much older ex-servicemen, cynical etc. - they were more politically aware than raw school leavers of which he was one. But Australia as a whole was politically quiet then - before PETROV affair.
- 210 Australia as a whole provincial then and now.
- 215 Escape from Australia. "My general education started then". Not interested in a specifically academic pursuit at that stage. Had pretty poor degree from Tasuni.
 Teaching in Tasmania briefly then in N. London. Staff there more intellectually alive". It was there he realised he would like to do research.
 Worked at Harwell; did Ph.D. at ANU, then left Australia immediately, and had no wish to come back. Good impression of ANU - did not feel he was back in the colonies while there. Would never have returned to Tasuni.
- 285 Life in Christ College.
 Didn't get in in first year (1947) because of rush of ex-servicemen.

MAINSBRIDGE, Professor Bruce (contd.)

Lived in 'digs' for a year. "That was dreadful".

(Query: Would ex-servicemen have had priority over school leavers?).

[Brief excursus on parents' EXCELLENT attitude to education].

Warden was Canon Barrett, nicknamed Baron Carrot (or Barren?).

Elderly retainer called Robbie who smelt, but made your bed. "Quaint European cooks" - a new thing in Australia in those days.

How traditional was Christ College?

It was on the surface. Chapel not compulsory but strong pressure from evangelical ex-servicemen.

Formal college meetings. New warden "a frightful prig from Cambridge" more interested in students than Barrett, but unable to cope with rough Australians.

There was a feeling of "academic activity" at CC "It had the germs of a real traditional College in it ... but it was pretty half mast".

385 Establishment of Jane Franklin Hall - involvement of the church and the S.C.M. - role of Canon Barrett very efficient, ended "all too quick" - apparently no querying of OFF- CAMPUS site, "as University of Tas. was already schizophrenic". - JFH half way between the two campuses.

425 The first pantie-raid (as it were) - Dinner swapping - all men at dinner at J.F.H., no women. Aplomb of Principal. "What have you done with my girls?"

465 Group spirit of Christ College "as a country boy it helped me enormously". Point system: honour system: fines for being out after midnight. Privileges of senior students.

In favour of collegiate system. Best time for young to leave home. But lack of privacy - college life not all good.

550 Summing up: In the forties most Australian universities were not achieving very highly.

Aust. universities do not/did not have enough variety - disturbing uniformity.

Contrast with American university system.

Tribute to Murdoch University, because of its attempt to be different.

END

DR. ARNOLD'S LEGACY

Inaugural Lecture by Bruce Mainsbridge,
Foundation Professor of Physics, Murdoch
University - June 15th, 1976.

*Set subject
inferred with
Professor Mainsbridge
(31)*

Sixteen Australian Universities preceded the foundation of Murdoch University and throughout Australia, it has been recognized for its innovative approach to undergraduate teaching and for having departed from traditions. But what are those traditions and in the long history of academia, how innovative have we been?

In the 1850's Murdoch's University would have had many supporters, including W.C. Wentworth and the foundation professors of the University of Melbourne. The great flux of staff through Australian Universities since those days has left the history of our own Universities in a fragmented state. I am confident that much of what I am about to tell you is novel, but it ought not to be. If you are surprised that a Foundation Professor of Physics is telling this story, it is only because the Planning Board of this University proposed a plan much in sympathy with advice offered in Sydney and Melbourne one and a quarter centuries ago, but tempered with dividends from the evaluation of Australian Universities by Australians which began in the 1940's. Happily our Planning Board did its homework.

Reading the handbooks of the University of Sydney from 1860 onwards, one can observe that Australian Physical Scientists have been teaching by one method, essentially the same first year content for over a century, despite all the revolutions in the physical sciences in that time. In 1914, the British Association for the Advancement of Science held a meeting in Melbourne. Lord Rutherford was there, and presumably sat through the lecture by the Professor of Chemistry objecting to the concept of isotopes because there was yet no chemical evidence for them! The Planning Board for Murdoch University also offered a challenge to the Physical Scientists, only a little more painful because of the tardiness of our Australian predecessors.

Physical Scientists in Australian Universities hold another record; only thirty percent of our students graduate in minimum time. In 1957 the Murray Commission on Australian Universities referred to this as "an extravagance no country can afford", and identified the first year courses, heavily populated with prerequisites, some of them perhaps unnecessary, as the critical area. The flush of funds which followed the Murray Commission report, even the earlier wartime restrictions which limited university entrance to the ablest students changed the pass rate so little that it has been called our own Law of Inertia. Others have described it as a bad habit reaching back to the foundation of Australian Universities.

The early Australian Universities were founded about the time when the English educational system was responding to domestic demands for reform and the pressing needs for an export model university for Ireland, India and beyond. In the 1820's the intellectual dialogue between learners and learned in the great British public schools such as Eton, Harrow, Rugby or Winchester was described by one observer as a system of anarchy tempered with despotism. The Reverend Bowdler described them as "The very seats and nurseries of vice". Oriel College in Oxford was a centre of reform and one of its fellows, Thomas Arnold, became Headmaster of Rugby School in 1828, "to change the face of education all through the public schools of England". He was a happy, busy extrovert, a fine preacher in the Evangelical style ever looking forward to "the approach of a greater struggle between good and evil than the world has yet seen". "No one could know him even a little and not be struck by his absolute wrestling with evil so that like St. Paul he seemed to be battling with the wicked ones and yet with a feeling of God's help on his side".

Dr. Arnold's great object was to make Rugby School a place of truly Christian education. His major reform was directed to the system of government and discipline of the school. By converting the sixth form into an organ of government, every sixth former became a Praeposter with powers extending over every department of school life; the sixth form as a body was erected into an authority responsible to the Headmaster, and to the Headmaster alone, for the internal management of the school. Dominated by his strong character and his unquestionable expectations of students' behaviour this system worked, and freed him to continue in the many activities open to a Headmaster of such a prestigious school, including foundation membership of the University of London. His work has been chronicled in Dean Stanley's "Life of Dr. Arnold" and much of what I am able to tell you comes from the voluminous correspondence published in that book, dealing with topics covering every aspect of human activity in the quickening pace of trade and commerce in the new industrial England. Of particular concern to him was the debate on the relationships between Church and State. He saw the moral condition of the United States as a threatening prospect; he abhorred the American War and the spirit of the French economists and the English Whigs of the latter part of the seventeenth century; and he always entertained a profound respect for the hereditary peerage. He

practised toleration within limits: "I would give James Mill as much opportunity for advocating his opinion as is consistent with a voyage to Botany Bay". He sympathised with the lower orders of society and classified them into two classes, "the good poor and the rest". "He did not beat the sixth formers; they were excused from chastisement but had the right to chastise the younger children of Rugby School. Scourged both by Dr. Arnold and by the sixth formers they were given every opportunity of acquiring the simplicity, sobriety and humbleness of mind which are the best ornaments of youth". Arnold's reforms were largely organisational and the teaching reforms were limited. He introduced Modern History, Modern Language, and Mathematics into the school curriculum but the results were not encouraging and he had a personal preference for the study of the languages of Greece and Rome. Physical Science was not taught at Rugby School because "It was too great a subject to be studied superficially. Obviously only two alternatives were possible, it must either take the chief place in the school curriculum or it must be left out altogether. Rather than have physical science the principal thing in my son's mind, I would gladly have him think the sun went around the earth and that the stars were so many spangles set in the bright blue firmament, surely the one thing needed for a Christian and an Englishman to study is Christian and moral and political philosophy".

We live in another era but the daily round at Rugby School is described in Thomas Hughes' novel "Tom Brown's School Days". The expectations of parents who sent their children to the flourishing Rugby School are summarised by Tom Brown's Father. "I don't care for Greek particles or for the dogma; no more does his Mother, what is he sent to school for?....If he will only turn out a brave, helpful, truth-telling Englishman, and a Christian, that is all I want". Pious Tom Brown not only lived up to his parent's expectations but managed to fictionalise Dr. Arnold. The process of debunking Dr. Arnold has continued with the recent literary hoax where George MacDonald Fraser claimed to have discovered the papers of the cad of Rugby School, Flashman, the ignominiously expelled, dissolute bully who left Rugby School to win fame and fortune as a hero of the British Empire. Harry Flashman of the San Serafino order of Purity and Truth, 4th class, was an eleventh commandment fiction who went to India, but J.P. Gell was fact and was destined to go to Van Diemens Land, led, or perhaps driven, by the zeal and drive of Dr. Arnold. I must leave you in suspense while we go back to some of the earlier correspondence of Dr. Arnold and his battles as a foundation member of the University of London.

The Anglican Kings College in London opened in 1831 but an earlier institution University College, opened in 1828. By excluding Christian teaching from its syllabus it became known as "That Godless institution in Gower Street". The University of London was founded in 1836 to accommodate these two colleges and was also unique; it was founded solely to conduct examinations for students of these two independent colleges; it was governed by a Senate which did not consist of representatives of the two colleges, but nominees of the Privy Council. Staff of the University of London were in all but name civil servants and none was a teacher. The University of London was definitely to be free of any religious test. Dr. Arnold did not approve. Writing in 1837 he observed

"Now are we really for the sake of a few Jews who may like to have a Degree in Arts, or for the sake of one or two Mahomedans, who may possibly have the same wish, or for the sake of English unbelievers, who dare not openly avow themselves are we to destroy our only chance of being either useful or respected as an Institution of National Education?....It is better to go on with our present system with all its narrowness and deficiencies than to begin a pretend system of national education....on any other than a Christian basis....The University solemnly avowed a principle to which I am totally opposed that education need not be connected with Christianity." His Bishops did not support him and the University of London became Godless, but not Greekless.

Another recipient of Arnold's strong advice was Sir John Franklin, KCB. who in 1837 became Governor of Van Diemens Land. Let me quote from his letter of congratulations of 1836. "There can be, I think, no more useful or sacred task, than assisting in forming the moral and intellectual character of a new society; it is a surest and best kind of missionary labour. But our colonial society has been in general so Jacobinical in the truest sense of the word; every man has lived so much to and for himself and the bond of law and religion have been so little acknowledged as the great sanctions and security of society that one shrinks from bringing up one's children where they must in all human probability become lowered, not in rank or fortune, but in what is more infinitely important in the intellectual and moral and religious standard by which their lives would be guided."

"Feeling this, and holding our West Indian colonies to be one of the worst stains in the moral history of mankind the convict colony seems to be even more shocking and more monstrous than its very conception. I do not know to what extent Van Diemens Land is so; but I am sure that no such evil can be done to mankind as by thus sowing with rotten seed, and raising up a nation morally tainted in its very origin. If they will colonize with convicts, I am satisfied that the stain should last not only for one whole life but for more than one generation; that no convict or convict's child should ever be a free citizen; and that even in the third generation the off-spring should be excluded from all offices of honour or authority in the colony. It is a Law of God's providence which we cannot alter that the sins of the father are really visited upon the child in the corruption of his breed, and in the rendering impossible many of the feelings which are the greatest security to a child against evil".

"Forgive me for all this; but it is really a happiness to me to think of you in Van Diemens Land, where you will be I know, not in name or in form but in deed and in spirit the best and chief missionary."

Sir John Franklin was one of the ablest of the Australian Colonial Governors; after his Governorship he lost his life on an Arctic exploration; he shared with his wife a genuine interest in the colony and its problems. Their intellectual pretensions were a source of comment in the colonial press and much fun was made of their preference for tea parties and lectures. Lady Jane Franklin

accompanied her husband on many difficult explorations in the colony, had a strong interest in classic architecture and was partly responsible for the late Georgian appearance of the City of Hobart. Some of you may have visited the Greek temple she constructed in the bush, now surrounded by outer-suburbia of the City of Hobart.

Van Diemens Land was the second Australian colony and until 1820 had the sole purpose of accepting British convicts. The system grew and flourished. Governor George Arthur, Franklin's predecessor, from 1824 to 1837, had been responsible for opening up the unfortunate island to free settlers and although much has been made of the cruel and harsh conditions of the convict labour system, it is not generally appreciated that Governor Arthur had the broader task of developing communication and commerce in the state. Only twenty-five years after the colony was established he was exploring the problems of providing an education for the citizens who had acquired ticket-of-leave; and for the increasing number of free immigrants. In 1839, two years after Sir John Franklin's arrival, the Colonial Secretary gave consent to the formation of a university college in the colony. In the words of Sir John Franklin's grandson "Many who in those days ceased to be convicts preferred the possibilities of the attractions of colonial life, settled down and sent for their families. Many were of good birth and education who had gone astray so that a higher class grew up who were worth something better in the matter of education". Despite the tone of his congratulatory letter to the Governor-elect and despite his objections to the non-sectarian nature of the University of London, Dr. Arnold was consulted by the colonial secretary of the day, Lord Normanby, on the way of launching such an ambitious scheme. Arnold seems to have been a very sensible man in practical matters and he nominated one of his favourite pupils, J.P. Gell from Christ's College Cambridge, to go out to the colony with three colleagues to found a "great school in Van Diemens Land which it is wished to establish on the very high scale, in the hope that it may hereafter become a college or university of that part of the world"...Sir John Franklin he said "was a Christian, a gentleman and a scholar, a member of one of our universities, a man of ability and of vigour of character to become the father of the education of a whole quarter of the globe and to assist under God's blessing, and with the grace of Christ's spirit, in laying the foundations of all good and noble principles not only in individual children but in an infant nation which must hereafter influence the world largely for good or for evil."

J.P. Gell with his colleagues from Christs College, Cambridge arrived in the colony in 1840 and finding the standard of education at that time not to be sufficiently high to furnish a satisfactory supply of students for the proposed college he was placed in charge of what Sir John Franklin called "an initiatory institution intended to prepare boys for the future college". A five year development plan of education for the colony was prepared. By early 1841 Arnold was writing "I am appointed, with Dr. Peacock, Dean of Ely, to draw up a Charter for the proposed College in Van Diemens Land which will again force me upon the question of religious instruction without exclusion, one of the hardest of all problems.

In all the British colonies, it is manifest that the Scotch church has exactly equal rights with the English. Equal rights even legally, and I think, considering Ireland, that the Roman church has equal rights morally. Yet to instruct independently of any church is utterly monstrous and to teach for all three churches together I think is impossible. I can only conceive the plan of three distinct branches of one college, each sovereign in many respects but in others forming a common government." Young Gell had a ceremony to set the foundation stone for the Anglican college in 1840 in the village of New Norfolk some twenty miles from Hobart Town, but it is reported that nocturnal revellers from the nearby Bush Inn threw the foundation stone into the river. An alternate history claims that the stone disappeared because of the Presbyterians' objection to its inscription "To Christ Himself the great corner stone of the building intended to train our Christian youth in the faith as well as Christian Gentlemen". Sectarian anxiety, coupled with the hostility between Montague, the Van Diemens Land colonial secretary and Sir John Franklin caused the college plan to be struck off the estimates in 1843 and a special appeal was organised and addressed to friends in England. Sir John Franklin who had returned to England gave £500 from his own purse and the donations were so generous that by 1846 Gell had managed to mastermind an integrated education system in the infant colony based on two secondary schools, the Launceston Grammar School and Hutchins School in Hobart, and the Christ College, as it was named by Arnold and Gell, not at New Norfolk but on the Episcopal See in the northern village of Bishopsbourne some twenty miles south of Launceston. The foundation also allowed substantial scholarships to enable undergraduates to go on to an English University. One of these scholars was Lewis, Premier of Tasmania at the time of Federation, who went to Balliol College. Eight years after his arrival in Van Diemens Land the young Reverend Gell was able to return to England having established an integrated secondary and tertiary education system which continued to flourish; a very impressive achievement for a group of young men admittedly backed by influential circles in London. In 1855, it was reported that there were forty-two students in residence in Christ College (incidentally the same number as at the University of Durham at that time) and plans for extension were in hand, but shortly after that a great change in the structure and the stability of the Australian colonies occurred. For Van Diemens Land transportation of convicts ceased and with it the steady flow of funds from London. Franklin and Arnold were dead. Gold rushes in New South Wales and Victoria brought about a great economic instability in all the Australian colonies and Christ College closed for twenty years until the endowments built up. It moved to the City of Hobart and in 1890 its building became the University of Tasmania, Christ College remaining as a residential college of the University as it is today.

Arnold's Charter anticipated the development of an Anglican College, a Scottish College and possibly a Roman Catholic College in Van Diemens Land and together they would form some degree-granting body on the University of London model, however while the Presbyterians were willing critics of Gell's work they were less responsive to the opportunities available to them and other colleges never started. Christ College has the unique distinction of being one of the earliest overseas British University establishments outside North America, preceding the formation of the University of Ireland in 1849, Sydney in 1852, Melbourne in 1855, Calcutta in 1857. Arnold, and others, saw the London model as the answer to sectarian issues evident in all the Empire.

J.P. Gell wrote "I have understood my commission to be the foundation of an institution meant to keep at the head of the scholastic establishments of the country and to draw them up to the standards of English schools while growing itself into the full stature of an English college to be a stronghold of learning and a school of Christian gentlemen. The object of the college in the first instance is not to form schools of divinity, law, physic or natural philosophy but to prepare men in a proper system of discipline, development and useful information for entering on professional studies. And let it be remembered that the difficult task of establishing sound and liberal learning in a new colony requires particular support, for it will never find itself at home among the restless society of a colonial town and if we do not take care of learning neither learners or learned men will come to us".

The ingredients of success were the firm support of Arnold and Franklin and the adaptability and enterprise of Arnold's men conveniently 10,000 miles from his dominant will, but committed to sound and liberal learning.

Arnold and Franklin were pioneers but the new Indian and Irish foundations intruded on the plans for the Universities of Sydney and Melbourne as we shall now see.

Trinity College in Dublin, an ancient Anglican foundation, whose exclusiveness has been cited as one of the many causes of civil discontent in Ireland, was under criticism and there were pressures for the development of a comprehensive education system for Ireland, available to all free of religious tests. This culminated in the establishment of the Queen's Colleges of Ireland at Belfast, Cork and Galway by 1852. Each had its own syllabus and the Queens University of Ireland in Dublin was a London-type examining body examining students in Greek, Latin, French or German or Italian and Mathematics at Part I level and any five of English, Philology and Criticism, Logic and Metaphysics, Jurisprudence and Political Economy, Chemistry and Natural Philosophy, Zoology, Botany and Physical Geography. Thus the Queens Colleges of Ireland were able to democratize the curriculum far beyond the possibilities at the University of London some twenty years earlier. In addition there were professional faculty in medicine, law, engineering and agriculture, and another innovation for the 1850's was for the provision of the teaching of Gaelic.

Far away in India, the East India Company had earlier turned its attention to the training of indigenous Indian staff to assist the company in its enterprises and by 1781 Warren Hastings established a new Madrassa in Calcutta to provide the customary pattern of Islamic studies characteristic of those ancient foundations. In 1792, John Duncan, the resident for Benares, founded a complementary institution for the preservation and cultivation of the laws, literature, and religion of the Hindu. Both men were influenced by the practical consideration of the need for native officials to assist in the administration, as well as to cultivate the good will of the two Indian communities. But they were also inspired by a general admiration of the Indian cultural heritage and the need to promote its studies. This early disposition to foster the existing

native system of education was questioned in London, and controversy raged about the competitive values of tertiary institutions based on indigenous culture against universities based on the European tradition. The issue had been referred to the historian Macaulay who saw in the model of the University of London, an administrative convenience which avoided the sectarian issues dividing the Indian people. He advised that the government should stop the printing of books in Sanscrit and Arabic and cease the patronage of indigenous studies, but reinforce the expansionist philosophy of the British system with a monumental sentence, "The aim of tertiary studies in India should be to form a class of persons, Indian in blood and colour, but English in taste, opinions, morals and intellect". He rationalised the dilemma over the abandonment of the languages of Sanscrit, Arabic and Persian with the observation "English language was to the Indians as Latin and Greek were to the Englishman". The University of Calcutta which emerged in 1857 was thus based on the University of London model but with a totally different social function. It had to provide a test of eligibility for government employment and to transmit an alien culture. The office of Chancellor was assigned to the Viceroy whose duty it was to nominate the Vice-Chancellor and appoint and dismiss all but the ex-officio Fellows. The two functions of the University, and its involvement in scholarship were obscured by the expediency necessary to ensure a totally alien implantation, disregarding the religion and culture of the Indian people. Twenty years earlier, the Orientalist, Professor H.H. Wilson, sounded a prophetic warning:- "A whole people dependent on a remote and unknown country for all their ideas and the very words to clothe them must degrade their character, depress their energies and render them incapable of imposing any intellectual distinction". Thus the nineteenth century British Indian University was placed under stress by environmental factors. By linking the University to employment prospects the planners exposed the colleges to relentless economic pressures which stimulated a rush of students to the university examinations. The purely examining university, set up to avoid sectarian issues, was too remote from its teaching colleges, and its ability to exert influence was severely limited. When declining academic standards were noticed, the only machinery available to the university was to raise the pass mark; between 1890 and 1900 the failure rate rose from 50% to 75% without any apparent effect on standards. A visitor to Aligarh, a College of the University of Calcutta, in 1880 recorded "Calcutta sets books, not subjects, even in mathematics and accordingly the normal method of teaching has been to pick through the books at so many pages a day". Lord Ashby in his book "Universities: British, Indian, African" has done us a valuable service in recording the evolution of universities in the English speaking world. I am sure that debate on the future of universities in our nation will involve the role of government in higher education. History has a habit of repeating itself and his book has a wealth of useful information. The sub-title is "A study in the ecology of higher education". Indeed one needs the conceptual framework of an ecologist to become a foundation professor in a new university.

The first proposals for Sydney University were less concerned with the idea of a Christian gentleman and in 1849 W.C. Wentworth called for a University to "enable the child of every man of every class to become great and useful in the destiny of his country". Sectarian issues were avoided in Wentworth's proposal excluding clergy from government or teaching in the

University, but even this was too much for the citizens of Sydney, and eventually a Senate for the University was established allowing representatives of the four main religions in the city, but excluding the Professors. The University was to be like those of London and Calcutta, not a teaching university but an examining body and the Professors were to hold their posts in the colleges of the University. At Sydney ... "classics and mathematics were to be taught for gentlemen, in the style of the unreformed and ancient British University". It is not recorded that the University of Sydney might become an examining body for Christ College in Tasmania as well as the Sydney colleges. The first three professors arrived in Sydney in 1852, the Reverend John Woollie, a classicist from University College, Oxford, Morris Burkbeck-Pell, a Fellow of St. Johns College, Cambridge, a mathematician, and John Smith a lecturer in Chemistry from Marishal College, Aberdeen. Within a year they had abandoned the University of London model, had made themselves Professors of the University, and abandoned the Oxford and Cambridge tutorial system in favour of a system of lectures. The Colleges which were consequently founded under sectarian control at the University of Sydney did supplement the University teaching by tutorial work but their significance was much less than in Oxford and Cambridge. It was nine years later that the Professors were able to gain representation on the University Senate despite the resistance from the Lay-Governors. It is also interesting to note that Professor Henry Moulton, who had been consulted ten years earlier about the establishment of universities in India, was on the selection committee for the first professors of Sydney and Melbourne. By the standards then operating Sydney was largely a reactionary establishment and soon met the charge of relevance; enrolments were lagging and in 1859 the colonial legislature of New South Wales appointed a select committee to inquire into the progress of the University. They asked "Is the character of the classical reading so suitable to a young country where more practical pursuits are to be followed?" The reply was "We have attempted to found a University here on the principles which are generally received at Home, the ruling object in the examination for the B.A. Degree being first to train the mind for future courses of study or active exertion. No previous training is so good as a training in mathematics and grammar as given through the classical languages".

The first Chancellor of Melbourne University, Redmond Barry, required the Foundation Professors to display "Such habits and manners as to stamp on their future pupils the character of loyal, well-bred English gentlemen". Almost the same committee selected the Foundation Professors for Melbourne but this time they were wiser. Three of the Foundation Professors were from the Queens University of Ireland, Hurn from Queens College Galway, Wilson and McCoy were Professors at Queens College Belfast. The fourth Professor was Roe, a Cambridge classicist. "The Professor of Classics", wrote Redmond Barry, "must be of a hopeful, persevering and constant mind, not to be discouraged at the outset, for the sciences are at first more likely to prove attractive than studies judged by those unaware of their intrinsic value, to be rather superficial embellishments". Roe responded to this caution by dying within weeks of his arrival. The remaining three professors addressed a memorandum to the University of Melbourne suggesting a curriculum allowing a B.A. Degree to be awarded without any study in Latin or Greek at all. They hinted at the curriculum changes being considered in England and the reform of

the ancient universities. "In the colonies the conditions of society which gave rise to the English system never existed, the more closely the colonial universities resemble those of the Mother country, the greater the probability of failure". They went on to say "All subjects would prosper if they were freed of the dead-weight involved in any system of compulsory study". These reforms were a little extreme for the governing body in colonial Melbourne and they amended the proposal to guarantee at the University of Melbourne all B.A. candidates would pass at least two examinations in Greek and Latin and one each in Geometry and Natural Philosophy. Ashby has pointed out that the proposals of the Melbourne Foundation Professors introduced the idea of electives a decade before they were introduced to Harvard University.

In the foundation of Australian universities too many opportunities were lost in the conflict of values so characteristic of colonial societies. It was not until the 1860's that subjects such as English, German, Economics and Geology crept into the university curricula. Australia moved toward nationhood on a eurocentric education system and our universities only began to study themselves in the 1940's when the Universities Commission was founded, first to advise the Federal Government on University admissions during the war-time manpowering acts, and later to assist the universities in dealing with the rush of ex-servicemen returning from the war to resume their interrupted studies.

By 1957, the Murray Commission published the first major review of our universities and its recommendations initiated change. Universities are slow to adapt and our new post-war foundations have in their early years been the centers of reform. Reforms must be based on information and we owe much to Emeritus Professor C. Sanders of the University of Western Australia, and now Chairman of the Western Australian Tertiary Education Commission for his detailed studies of student performance in Australian Universities, particularly the post-war era when mature age students dominated the enrolments. Sir George Currie, Vice-Chancellor of the University of Western Australia from 1949-52 moved to the University of New Zealand. Their London-type university structure was then changed to form four autonomous Universities. In 1962 he returned to Australia to become Chairman of the Commission on Higher Education in Papua New Guinea whose 1964 report was a basis for the development of a complete tertiary education system in Papua New Guinea.

Thus, to many Australians Western Australia has earned a reputation for effective action in university development in our quarter of the globe. The general information booklet published by the Planning Board of Murdoch University in early 1972 included a positive change to the structural weaknesses in present day Australian Universities, recognised the importance of student guidance in the early years of their course work; the educational, and economic risks of zealous Professors who may fall into the trap of measuring their worth by the number of prerequisites they specify for their courses and the potential of interdisciplinary studies to many of the problems in Australian society today. W.C. Wentworth might have written their sentence "The Board is conscious of the fact that Murdoch University must be part of and make a contribution to the community that supports it". I see Murdoch University close

to Wentworth's dream of a University founded to enable the child of every man of every class to become great and useful in the destiny of his country.

While we all accept the need for achieving an internationally accepted standard of excellence in our graduates, we know enough of universities throughout the world to know that the pathways to that standard are not uniquely defined and Australian Universities have been too cautious in the past. Regional issues do influence practice and priorities.

Foundation Professors have, for a little time, the opportunity to set the directions of teaching and research, taking into account local conditions if they wish, and to speculate about the issues which may be important in the lifetime of our graduates. In Western Australia, I see a widely distributed population but the concentration in the City of Perth gives it some of the attributes of the City State so common in South East Asia. Country students are disadvantaged by remoteness; the education system seems to have limited the access of the aboriginal population. The Partridge Commission Report reflects the mood for change. Our affluence is such that a University can fully exploit the cultural value of a University education as well as the interest in professional training which has always dominated the activities of the physical scientist in Australian Universities.

The degree structure of Murdoch University, particularly in first year, departs from the usual arrangements in the older universities, but there are environmental and behavioural reasons for the plan which has changed the pattern of first year physical science courses considerably, giving access to a broader range of students than has been the custom. I believe this to be a beneficial reform long overdue in this country.

In 1849 an Oriel College Fellow commented on the formation of their school of modern history "Rightly or wrongly we have fallen into the weakness of yielding to the spirit of the age". It is easy to dismiss reforms in modern universities as merely products of the spirit of the age, but today we are wiser and better informed about communication between the learners and the learned. Much of this information has come to us from the improved techniques of research in the behavioural sciences, to which physical scientists have contributed.

In 1922 Jan Piaget was present at a meeting when Albert Einstein presided over a meeting of the philosophers of science. Einstein who had changed dramatically our view of space and time, asked the philosophers of science to determine the way in which concepts of space and time are formed in young children. In the late 50's and early 60's this work reached a peak with the efforts of Bruner and his colleagues at Harvard who have assisted the development of the courses "Web of Life" and "Project Physics", now in use in Western Australian secondary schools. The emphasis has moved from facts to the formation of concepts. Since the conservation

of physical quantities occur earlier in action than as linguistic judgement, the teaching the physical sciences is moving into primary schools where action-oriented procedures are encouraged to assist the students' comprehension of quantities such as time, space, force, mass, volume, speed, acceleration and the properties of the states of matter. It is appropriate that primary teacher education is being offered as a professional course on this campus and with which the physical scientists co-operate.

For many years the publication of new information in the physical sciences has been doubling every decade. Curricula have become crowded with more and more information while the means of instruction has been static for a century. Looking at the catalogue at say, the University of Sydney for the years 1886 to 1976 it is evident that we have been teaching in our first year classes the same information in approximately the same order and by a straight lecture system. But there have been changes in the techniques of communication and we have been free to reorganise the content and approach to the discipline. In these stringent days economists and planners have been asking for cost benefit analysis of the teaching process in a university and there are methods of instruction which may be more productive for the undergraduate than past techniques.

Ten years ago in the Flint College, University of Michigan, DeGraaf and his colleagues set down a complete introductory undergraduate curriculum in physics and broke it up into some seventy topics. For each topic a study guide was prepared listing the aims and objectives of the study guide, the reference material to be read and a set of minimum learning goals for the student to achieve. It is thus possible for the student to work from the study guide entirely independently and at a pace suited to him and his other commitments on the campus. By de-emphasizing the time factor in a programme of study it is possible to require each student to achieve full competence in a set of learning goals for that particular unit of study. This scheme also has the advantage that the plan allows individual students to study their courses in a variety of sequences matched to both his academic background and his future plans for study on the campus. A physical chemist and a geologist might choose different pathways through this maze of physics topics. The Keller Plan of study which is similar, eliminates lectures and directs the student to a series of units of study with unit tests requiring 100% competence at the completion of each unit. We are moving away from the competitive grading of students toward the achievement of a set of criteria in competence directed to the individual student.

Postlethwaite in the United States has also introduced a similar system for the teaching of biology laboratories, again removing the laboratory session from a timetable and leaving the laboratory open for the full working week. Apart from drastically reducing the capital investment necessary to set up a laboratory for say 100 students the system also allows the student to work at his own pace. Instructions to the students are given either on tape-recorders which they collect on entry into the laboratory or in printed instructions. To complement these self-paced learning

techniques the movie film, the film-loop projector, the magnetic tape-recorder, the slide projector, the video-recorder, and the computer terminal have freed the demonstrator from the routine tasks of instruction. In conservative circles these techniques are dismissed as gimmickery or because they require too much work to get started, but the techniques allow the student to acquire more independence in thought and in action and this is promising to be the strongest attribute of our Murdoch graduands. I do not want to denigrate the lecture but to emphasize that communication between the learners and learned is more effective when a variety of means of communication is available.

Self-paced learning systems based on study guides can allow a university to relax its entry requirements for the physical science courses. These techniques also lend themselves to external teaching in the physical sciences and we are providing such a service to the students in remote areas of this State.

In our actual course construction for the Physics programme, we have been able to define a programme including the basic concepts, principles and skills of physics, and applied mathematics as well as allow students the time if they wish to work in interdisciplinary areas of interest to them. Environmental science and biology are obvious choices. In this country, we can, and should, allow a student to include an Asian language in his degree programme should he so wish. We are particularly concerned to cater for students who have an interest in the role of science in technology and society, and an historical view of the discipline which will give him or her an awareness of its limitations.

Another remarkable feature of this State is its dependence on the wheat and mineral harvests for prosperity. We have high expectations of our mineral industry despite an apparent coming shortage of fuel and water to maintain this development; important decisions have to be made about the capital investment in energy production and in its transmission. Our agricultural industry uses large amounts of energy in the boosting of production and in its harvest.

Efficient use of energy involves the harvesting of the sun, either through direct solar absorbers or the process of photosynthesis. The extraction of minerals requires an understanding of the surface properties of minerals. As we become in the next decade or so, increasingly desperate for fuel supplies we will probably be involved in the problem of upgrading hydrocarbons from coal to prepare fuels that burn easily and can be transported by pipe-line.

One only has to look at the pattern of water consumption and exploitation of the water-table to realize that the City of Perth is facing a limit to industrial growth. One even wonders if the suburbs of Perth will ever reach and embrace Murdoch University before the water runs out. As our need for fresh water increases it is likely that we will have to choose between towing ice-bergs of

fresh water from Antarctica, and this is seriously being considered for metropolitan Perth, and the desalination processes which involves reverse osmosis or the transport of water through a membrane. Alternatively we may become involved in understanding the mechanisms of cloud formation and precipitation. If in the next fifteen years we are going to consume as much energy as has been consumed since our history began, is our society sufficiently developed in its concepts of domestic and industrial energy conservation to avoid wide-spread economic stress when we search for the funds to augment our diminishing energy supplies? Much has been made of the importance of solar energy to the nation but how much attention has been given to energy production from the winds and waves which sweep the southern part of our State each year? Visitors to the City of Perth in the 1940's called it a "city of windmills". Since then they have been replaced by the electric motor but need to come back perhaps as improved models. If the tides of the north can be used to generate electricity, how can it be transported efficiently to the populated part of the state? By generated hydrogen and transporting it through future pipe-lines? Or by the development of low temperature transmission lines cooled by liquid nitrogen to minimize transmission losses? Could we exploit our marginal lands for wheat growing more efficiently by copying the Russians in their novel planting techniques for wheat in marginal lands directed towards minimizing water loss through capillarity and evaporation? How many people are aware of the physical process controlling the movement of water from the soil through to the atmosphere so that the novel farming techniques now moving into Europe, avoiding the use of the plough be introduced here? I don't want to tire you with rhetorical questions but Walter Murdoch was right, "As regards to the huge continent we have the effrontery to say we inhabit. Most of us here have never seen it: we have camped on its outermost rim and we are content to stay there."

I believe we should bring back into the undergraduate curriculum the classical studies of fluids, surfaces and the solid state which have been neglected in recent years. Because they are relevant to life and environmental problems, these studies should be as accessible to Western Australian students as possible.

For this reason we are investigating ways of teaching the physical sciences to undergraduates without the formal school background in physical sciences. As the movement to abolish the leaving examination moves through Australia, I am sure this will become an important matter for the future.

I also believe that these physical processes have a relevance to our research effort. If one talks about solar energy absorbers, reverse osmosis for the desalination of water using membranes, or catalysis to lower the temperature and increase the rate of a chemical reaction one comes across the word surface, and we are developing a research programme directed to the physics of surfaces. Most industrial chemical processes are promoted by catalysts so that they have been the object of extensive scientific investigation and that a large body of knowledge and experience has been accumulated. Yet the rich diversity of phenomena observed in their complex nature has so far prevented a detailed understanding of the fundamental processes involved. For instance several processes for the gasification of coal exist, and metal catalysts such as

platinum are used in the hydrogenation and dehydrogenation of hydro-carbons. Metal catalysts are divided into fine powders to increase their effective surface area and chemical reactions are initiated on the surface but the density of atomic steps on the catalyst's surfaces is not known well because of technical limitations. During the last ten to fifteen years the improved techniques in vacuum technology, largely motivated by the semiconductor industry, has allowed very clean surfaces to be studied in a vacuum by scattering an electron beam off the surface and studying the pattern of electron distributions. The diffraction pattern shown is from a surface of molybdenum with an ordered layer of chemisorbed oxygen atoms. The pattern gives an indication of the atomic arrangement on the crystal surface. Dr. Jennings and Miss Read have been analysing such data. Just as it was a long step from the discovery of fission in the early 1930's to the explosion of a nuclear bomb thus turning some physicists into nuclear engineers it is just as long a path to move from the study of atoms adsorbed onto a crystal surface in two dimensional arrays to a deeper understanding and improvement of the complex process of catalysis. The physicist works in these areas knowing that the long term dividends are likely to be in areas of use and relevance to the industrial technology of the next decade.

The very precise specifications of vacuum in low energy electron diffraction and Auger spectroscopy are not as important as the process of scanning electron microscopy. In the scanning electron microscope metal or carbon is evaporated onto the surface to be studied and again an electron beam is directed on the specimen in a vacuum and the reflected beam gives an accurate profile of the sample being studied. It is my hope that in the long term the surface studies will extend to the study of biological material in particular membranes whose surface properties are important to understanding the complex role of biological surfaces in such areas as photosynthesis. This slide gives you an illustration of two types of sections of two leaf systems one from the common bean plant and the other from a New Zealand salt bush plant. The structures are quite different and in recent years the relationship between light intensity and photosynthetic rates have been measured for individual leaves of a wide range of plants. At high light intensities two distinct types of response have been identified and it appears that most species of plant fall into these two distinct classes. Out in the field, high light intensity often means high leaf temperature and the two types of leaves already shown from the scanning electron microscope picture also exhibit a different response at temperatures at the order of 30°C. Type C4 plants increase their photosynthetic rates but type C3 photosynthesis is inhibited at that elevated temperature. C4 plants are more efficient machines. The explanation for this different temperature dependence is by biochemical but the electron micrographs of the sections show the different physical structure in the leaf and an easier pathway for the molecular diffusion of carbon dioxide through the intercellular air passages to the chloroplasts. In C4 plants when the chloroplasts often appear in two distinct cell layers concentrically arranged around vascular bundles.

Thus, sugar cane is a relatively efficient photosynthetic machine for the harvest of sunshine and the tropical end of this state could become a source of industrial alcohol in the future.

It would be pretentious to claim that surface physics will solve the state's problems, but basic studies in this area have their own intrinsic interest and are pointing in the general direction of some of the issues which will become important in our economy in the next few decades, which are going to be difficult for any nation lacking total self sufficiency.

Had the reforms started by Arnold's men been continued by the foundation professors at Melbourne over a century ago, Australia might have gone into nationhood knowing more about itself and its neighbours. In 1942, Australia faced destruction. Too many of our crises have had their roots in our strange world view. At the least, Australian Universities have not helped much in the past and they are at the head of our educational establishment. Physical scientists do not boast of their involvement in Australian industry. An excess of claims for relevance and fundamental research come from the staff of CSIRO to whom the nation owes a great debt.

In the next two decades, Australians will be facing a large number of home truths in our quarter of the globe, and I know that the reforms initiated at this University have allowed Murdoch to examine some of these issues in its undergraduate courses. As Pax Romana yielded to Pax Britannica, the diversity in European Universities began. The conditions of Australian society today require more diversity in its universities. We are indeed fortunate to have a plan so responsive to Australian University experience and expectations. I believe Murdoch University is significant to the evolution of an Australian University tradition.

Someone has classified the arguments in our Universities as Eurocentric, Trans Atlantic, egocentric or productive. In listening to the productive arguments on this campus for the past two and a half years, I am satisfied that the vast reach of this University will bring us further to the ideal that "The child of every man has the chance to become great and useful in the destiny of his country" and "if we take care of learning, learners and learned men will come to us".

In conclusion, I would like to quote from J.P. Gell who wrote in 1843 from Hobart Town "Learning of that higher order which associates the sentiments with all that is stable and permanent is one of the most valuable advantages a nation can possess, but a possession which might never be disseminated at all, did it not enlarge the spirit of those who know its value".