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SOME ISSUES IN CURRENT BIOLOGICAL EDUCATION

A thesis presented in partial fulfilment of
the requirements for the degree of
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ABSTRACT

During the past decade, new biological curricula and courses have been formulated and incorporated into New Zealand education. Implied is that this 'new' biology is also a 'better' biology.

However, recently two trends have been noticed. Firstly, the world wide 'drift' from science continues unabated. Secondly, research in biology, especially in 'pure' biology is declining.

The 'drift' and the 'decline' in research continues in spite of new curricula at introductory levels. The drift from biology is obvious at the break between secondary and tertiary level education. Some factors which contribute to this drift can be found in secondary school biological education. Quantification, reductionism and factualism have been described. These factors can be classed as consciously or unconsciously held presuppositions or assumptions which are held by biological educators. They may not know that they hold these presuppositions, but curriculum makers and text writers reveal them when they write. Exploration of the unstated assumptions, possibly held by text writers and curriculum makers, is an important exercise in this thesis. For example, biological educators may never explicitly state that the 'new' biology is a 'better' biology. Instead by their writing it can be concluded that they do indeed make this assumption.

If biological research is declining and a drift from biology is continuing, it seems necessary for some unstated assumptions or presuppositions to be made explicit. Furthermore,

three possible remedies - the upgrading of biological theory, the extension of the observation phase, and the incorporation of the theory and methods of Natural History - are outlined. Biological theory, if encouraged in introductory biological education could promote unorthodox, but fruitful approaches to old and new problems in biology. Secondly, if the three above remedies are incorporated, the drift from biology may be abated. The mixed arts-biology students, could then advance into tertiary biology without being hamstrung by pre-requisites. Moreover, it seems probable that biological research could benefit from this substantial but currently neglected group. They seem to be characterised by having strong theoretical orientations which, if sustained, could benefit future biological research and biological education.

NEW BIOLOGY: A BETTER BIOLOGY?

During the nineteen sixties, prescriptions in secondary school biology were changed. Biological text-books, laboratory guides, and curricula have been modified. The old 'dogfish - earthworm" biology had been transformed into a 'new' biology, which stresses molecular aspects of biology:

> "During the past year or two, the New Biology in full official garb has begun to take the secondary schools by storm in a fashion uncomfortably reminiscent of the triumphant progress of the New Mathematics. Introductory courses in biology are being renovated, with the emphasis shifted from worms and dogfish to the beauties of nucleic acids.
>
> Yet the most exciting and significant aspect of recent progress lies precisely here: perhaps for the first time - or at least more insistently now than ever before - the key theme of a scientific biology is becoming a reality instead of a pious hope.
>
> That theme is the development of a unified and quantitative theory of how living organisms function, expressed in terms of the most fundamental explanatory concepts that can be used."
>
> (Reiner 1969).

Reiner does express some concern about the enthusiasm with which educational policy-makers formulate curricula, but he assumes, it seems, that this change from 'old' biology to 'new' biology can do nothing but good for the future of biology.

In New Zealand, in the nineteen sixties, policy-makers decided that modifications in biological education were necessary. Sixth and seventh form courses were renovated in the manner described by Reiner. A text book, and an accompanying laboratory guide have been published by the Curriculum Development Unit of the Department of Education. ("Biological Science. Processes and Patterns", 1969). This prescribes work for sixth forms. A teachers' guide has also been published with an accompanying cyclostyled laboratory guide which caters for seventh forms. (Form Seven Teachers' Guide,

University Bursary/Scholarship", 1970).

It is also probable that the fifth form biology prescription is due for modification and updating in the near future.

The cost of these elaborate and extensive publications, and the finance necessary for raw materials for practical work, is large. The policy-makers had to convince the Department of Education that these new courses would give value for money. That they seem to have achieved plausibility is surely some indication of the enthusiasm of the policy-makers and curriculum developers.

In general the 'new' biology' in New Zealand has been based upon the Biological Curriculum Studies courses developed in Colorado, U.S.A. The Nuffield Foundation of the United Kingdom have also been used as a model on which to develop New Zealand biological education. It thus seems that the transformation from 'old' to 'new' biology came about as a result of much careful planning and convincing. The work required in the organisation of 'in-service training courses' to keep biology teachers aware of the types of changes being sought, in the curricula must have been stupendous.

Enthusiasm for change was probably catalysed by an assumption that biology seems to have arrived at a point where a revolution was taking place. This revolution seemed to indicate that biology would be explained in terms of the chemistry of molecules. If this occurs, biology would seem to be attaining a maturity level similar to chemistry. It would therefore appear that changes in biological education toward molecular biology would represent an advance over the 'old'. Furthermore, the recent breakthroughs in the genetic code (since Crick 1953) seemed to indicate that most future biological research would be concentrated

at the molecular level.

This situation seems to imply a type of orthogenesis or 'straight-line evolution'. That is, the future will be exactly like the past. The past successes of molecular biology, it is assumed, will guarantee its future. The policy makers in biology seem implicitly to have accepted this situation. Yet it really means that the future will be non orthogenetic. If biology is to 'advance' the future must be continually changing. Thus there seems to be a paradoxical situation. The policy makers assume a guaranteed future for molecular biology, while on the other hand biology in general will keep changing. Also it means that past success is no guarantee of an assured future.

It is the responsibility of biological educators to prepare future researchers beginning at introductory levels so that they can enter research well grounded in the relevant approaches and information. Consequently biological education is very important.

But, despite the newly developed courses in biology being set in motion on a national scale, a major problem has arisen.

The 'Swing' or 'Drift' From Science.

There is evidence indicating trends which are percolating throughout science including biology:

> "Recruitment in the pure and basic sciences continues to show a relative decline. Not only are the basic sciences attracting relatively fewer recruits than the social sciences and humanities, there is evidence that the average calibre of the British recruits (as indicated by A-level pass rates) is also falling!"
>
> (D. Stenhouse 1965)

There is a 'swing from science'. Evidence can be cited from overseas (British and American journals) but it will be shown that the 'swing' is more widespread than this. The major contributing study to the 'swing' or 'drift' from science is the Dainton Report (1968):

> "For the present it is clear that the trends with time against scientific studies are general and by no means confined to Western Europe or even the Northern Hemisphere. It is therefore the more likely that they stem from very deep seated causes relating to the nature of the appeal of science and technology to young people under many diverse educational and social conditions."
>
> (Dainton Report 1968, Paragraph 125).

Evidence suggests that a number of factors may be contributing to the 'swing':

> "The present position, however, is that despite the impressive advances of modern research, and, although in the mortified words of the Dainton Report, 'nothing justifies a movement away from these subjects in schools' sixth formers have revealed something less than zeal for scientific studies. On this point there is small comfort to be derived from recent stories of a reduction in the swing from science if, as seems likely, all that is happening is an adjustment of subject choice to the economics of the higher education market place."
>
> (D. Layton 1972).

Secondly, it is <u>proportionality</u> which is important, and which (according to Dainton) complexifies the situation:

> "On this basis, it turns out that from 1962 to 1967 the proportion of students in the science group fell from 42 per cent to 32 per cent, while the proportion in the non science group rose from 58 per cent to 68 per cent. The Report points out, that because in those same five years, the proportion of the whole age group going on to the sixth form rose steeply from 11.5 per cent to 17 per cent, there was an over all absolute increase in the number of science specialists going into the sixth form; but it stresses the fact that that increase was very small as compared with the large increase in the number of new non-science students, and that, indeed, the <u>number</u> of new science specialists has <u>decreased</u> since it reached a maximum in 1964."
>
> (Thornton 1968).

The situation for Australia is little different:

> "The 1967 numbers are also available. They show that in that year more than twenty thousand new undergraduates entered the Australian Universities, 37.6 per cent of them going into the sciences and 62.4 per cent into the arts fields ... The national figures for 1967, showing in one year a fall of 3 per cent in the proportion choosing science, are striking indeed, and show that the trends of the 1962-66 period were continued in 1967 - and on the face of it, considerably accelerated."
>
> (Thornton 1968).

The effects of the drift may eventually have widespread national repercussions:

> " ... In 1962 the total number of new undergraduates who enrolled at all Australian universities was close to 14.5 thousand. Of those new undergraduates, 53.4 per cent enrolled in arts and 46.6 per cent enrolled in science. In 1966 the total had grown to 22 thousand, and the proportions became 59.4 per cent in arts and 40.6 per cent in sciences. In four years therefore, the proportion choosing science had fallen from 46.6 per cent to 40.6 per cent, a decrease of 6 per cent; at the same time (and necessarily because I am taking a simple and exhaustive dichotomy) the proportion choosing arts increased by 6 per cent rising from 53.4 per cent to 59.4 per cent."
>
> (Thornton 1968).

> "The danger lies in the fact that while our (Britain's) national welfare has become increasingly dependent on engineering, technology, and science, the percentage of 'dedicated young scientists' entering the sixth forms has dropped from 41.5 per cent in 1961 to 31.4 per cent in 1966. This means that science-based activities of society are rapidly losing favour among the brightest of Britain's young people just at a time when our national economy has been experiencing crisis after crisis. This deliberate turning away from engineering, technology, science, medicine and related work, will have far reaching effects on recruitment to those sectors of our national activities which are dependent upon science, and will aggravate the effects on society of the brain drain at high levels of expertise."
>
> (Rosenhead 1968).

Brian (1968) also emphasises the repercussions:

"Boys and girls in upper forms in our secondary schools are increasingly rejecting science as a field of study - the report establishes this as a fact, supported by abundant convincing statistical evidence. This bald statement needs some amplification as the situation is complex, embodying several distinct trends. Thus -

a) More young people are staying on at school - the national sixth form is getting bigger every time.
b) As a result of this general increase, the absolute number of pupils taking scientific subjects is still increasing.
c) Nevertheless the proportion of science students staying on at school is steadily declining, thus there is a relative decrease in science students.

And if the last mentioned trend continues, then in the very near future, the absolute number of candidates coming forward from school to university to study science or technology will decrease.

As the Report emphasises, it is from this stream that we get most of our dentists, veterinarians, scientists, technologists and engineers. We have here the makings of an alarming national situation which could jeopardise national development in the 1970's."

(Brian 1968).

"It is commonplace that the face of science can now transform itself within a decade; less familiar are recent changes in the patterns of recruitment to it. Against every economic of educational prediction, the proportion of young able men and women entering physical science subjects at English universities has begun to decline."

(L. Hudson 1968).

The reasons for the 'drift' are probably very complex. For example, one reason may be that there is opportunity to attempt new subjects at tertiary levels which were not part of the school curriculum. Social factors may also be involved. Evidence for this comes from an American journal:

"Somewhat more than half of those who in high school planned careers in science or engineering change their minds during the freshman year. In subsequent years the ranks are thinned only by about 20 per cent based on those who continue to graduation. One reason stems from appreciating for the first time the heavier work-load and heightened competitiveness that are the lot of science majors; the concomitants are a prospect of a diminished social life, and a kind of isolation because the substance of science is not an easy topic

of conversation. The other reason is simply the opening up of new possibilities for study and career areas that had either not been part of the high school education, or had been much less interestingly taught than science."

(Doty and Zinberg 1972).

Friedenberg (1961) places a great deal of blame upon science education:

"I am not enough of a Nationalist to wish to keep in science the ardent and promising youngsters who leave it, nor even convinced that it would be in the national interest, whatever that may be, to do so. But it does seem to me that the experiences that drive them out have far less to do with science as either a method or epistemological system than they do with science as a social institution. Those of our best subjects who left did so because of the way scientists are taught and the way they are used; not because of what science essentially is: after all, it is our respondents who believe that science deals with deep and fundamental issues of being, who are correct. But undergraduates do not get much chance to get down to fundamentals. It would seem that the sensible way for a nation to retain such youngsters, as future scientists and engineers would be to improve the way they are taught, and to modify the opportunities open to them in their later employment, so as to provide a legitimate expectation of personal autonomy in their work. But this is not the way our culture is going about it. Instead subject after subject in our study complains that the way the high school led him into science confused him and made it much harder for him to see how his career choice was going to affect his life and his image of himself. From an adolescent, considering what it is he has to do to grow up, this is a very serious charge against secondary education."

(Friedenberg 1961).

"Science teachers around the world are in a whirl. They are aware that their walls are falling down, and that their teaching is being exposed as self centred and inadequate. But where are the new boundaries to be constructed. And what is to be the new teaching? ... We know that the conformist is always safe. Life is laid out for him and responsibility is nil. But that is not what the next step in science teaching is about. Integrated science should plunge into the unkown, with the teacher preparing charts as he goes along."

(Goldsmith 1973).

These trends are clearly indicated in Graph 1 on the following page.

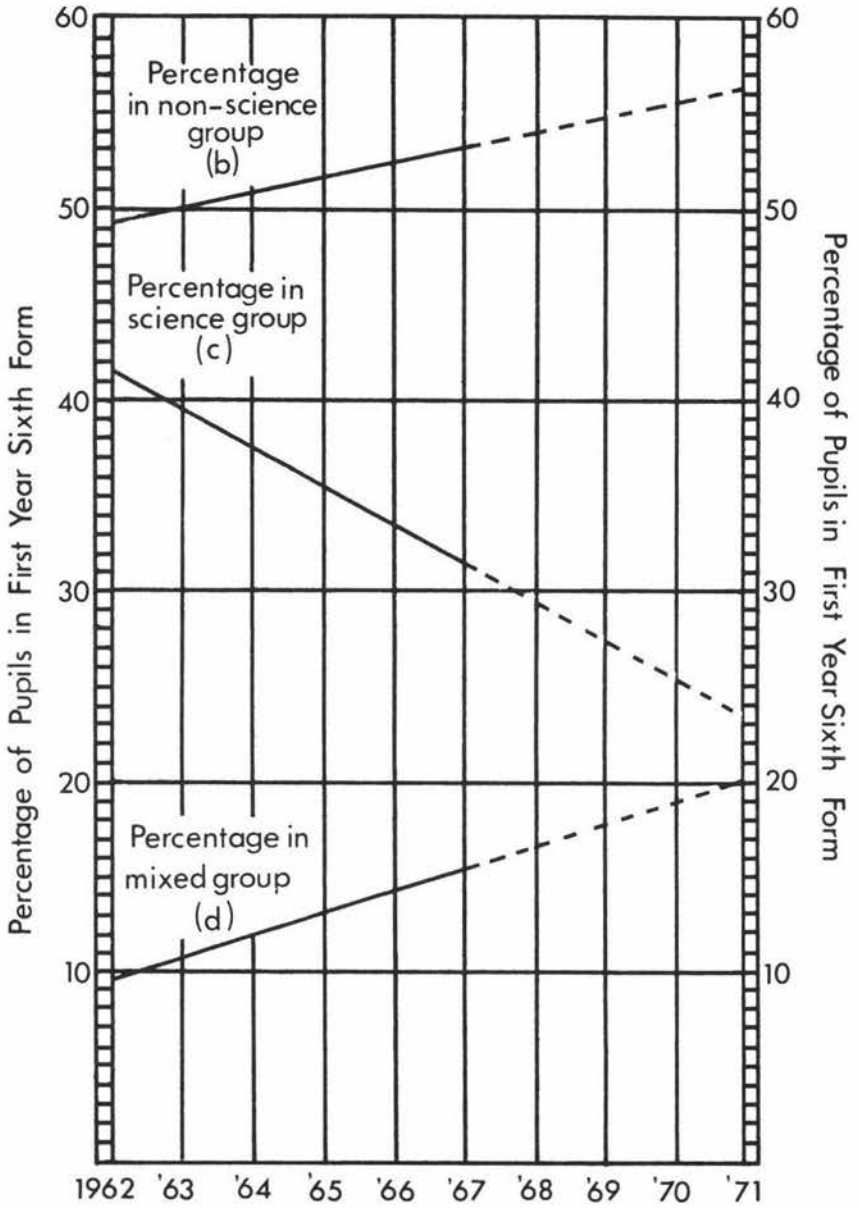
In the countries outlined, Australia, the United Kingdom, and the United States, the educational systems are diverse. Yet it is from these large and diverse educational systems which have been used as a basis for curriculum change in New Zealand.

It would seem therefore, that New Zealand curriculum planners have borrowed from curriculum plans to apply to New Zealand conditions, from systems where a drift from science is already occurring. This mimicking process is fully acknowledged:

> "Many persons have assisted in the preparation of this text-book. In particular the Department of Education acknowledges the generous assistance given by the Regents of the University of Colorado, Boulder, United States of America, on behalf of the Biological Sciences Curriculum Study. The writers have been able to use freely or adapt the text and illustrations from the three B.S.C.S. versions."
>
> (Department of Education Acknowledgements in "Biological Science, Processes and Patterns", 1969).

As already noted, the situation in relation to the 'drift' from science is complex. Many issues overlap and inter-relate.

The complexity of the problem can be noted by the extensive published argument which followed the release of the Dainton Report in Great Britain in 1968. Thornton (1968), Rosenhead (1968), and Butcher (1969) agree with the findings of the Dainton Report. MacPherson (1969) has strongly criticised the conclusions of the Report. Neave (1973) goes even further to cite evidence for a marked swing toward science. This will now be discussed.



Graph1: PROPORTION OF FIRST YEAR SIXTH ON EACH TYPE OF 'A' LEVEL COURSE.

After Butcher, May 1969.

A REPORTED 'SWING TO SCIENCE'

An article by Neave (1973) requires elaboration. The title given to his article is compelling - "The Swing To Science".

He bases his arguments around the apparent inadequate sampling procedures used by the Dainton Committee. This committee did not give sufficient weighting to the then newly established comprehensive schools which featured open admission into sixth forms. Rather the committee based its research around non-comprehensive schools in England and Wales, which had closed entry to sixth forms. That is, entry could be gained only through acceptable examination passes:

> "In none of the major works on this subject has there been any attempt to control school types. Indeed, the general conclusion from most previous studies is that the swing from the sciences is a general phenomenon in secondary education, affecting all types of schools to a greater or lesser degree. My study has revealed that there is not merely a 'swing from science' among students going to university from comprehensive schools, but rather a positive 'swing to science'."
>
> (Neave 1973).

A crucial statement in his articles discusses university intakes:

> "There is, compared to all other university entrants, a clear move to science. 36% of comprehensive students enrol for science degrees. 27% for the rest of the entry from other schools."
>
> (Neave 1973).

It would be a satisfying situation for science if that which Neave outlines actually was the case. But there are a number of inadequacies which make the Neave study far less important and compelling than the more pervasive Dainton Report (1968).

Firstly, Neave confines his study to comprehensive schools

alone. His study could therefore suffer from the same weaknesses that he attributes to the Dainton Committee. To maintain that there is a 'swing to science' from a study which is far less comprehensive than the Dainton Report is to convey an atmosphere of confidence in science where research is declining. (Zuck 1964; Brian 1969; Weiss 1970; Mellanby 1973; Levins 1973). Neave sampled from 163 comprehensive schools which had sixth formers during October 1968. Other schools which were 'selective' schools (having examination requirements before sixth forms entry) were not considered, but he did try to compare his findings with those of the Dainton Committee despite the fact that:

> "Dainton's information was gathered in respect of the year-group which entered university three years before ours. Thus an entirely reliable comparison between two groups cannot be made."
>
> (Neave 1973).

Yet, despite this admission, Neave goes on to attempt close and detailed statistical comparison with the Dainton report, to reveal its apparent inadequacies.

Secondly, Neave's study implies that trends are being investigated. But trends are better shown through longitudinal studies, than by a single study. The Dainton Report did attempt to derive data from over a period of years. Neave, on the other hand, did not. Thus it must be accepted that the Dainton Committee produced more comprehensive findings than the Neave study. To maintain a 'swing to science' from a single study seems to give no importance to the findings of a more comprehensive study which claimed a 'swing from science'. Yet Neave does consider some of the statistical data derived by the Dainton Committee to be sufficiently important for him to compare with his own data.

Thirdly, Neave attaches great importance to the 36 per cent of students entering science from comprehensive schools, in comparison with the 27 per cent from other 'selective' schools. This, in itself, according to Neave, indicates a clear 'swing to science'. But is it? Thornton (1968) for example maintains that a drift from science has occurred when the proportion of total entrants to university fell from 42 per cent in 1962 to 32 per cent in 1967 in Australia. Put within the context of trends, Neave's findings do not seem to indicate any marked swing to science at all. 36 per cent of entrants opting for science from comprehensive schools is not very significant when placed within the context of national trends. The slightly higher figure (36 per cent) could readily be attributed to initial enthusiasm of teachers and educational authorities for establishing and encouraging the relatively new comprehensive schools. The need for a longitudinal study again seems necessary, to observe if this initial enthusiasm for 'open entry' into sixth forms, and the more broadly based curricula systems characteristic of comprehensive schools is short lived or not. It would appear that as the enthusiasm subsides, then trends will further reflect those outlined by Dainton.

The 'open entry-selective entry' distinction requires elaboration. Neave does not define 'open admission'. Complete 'open admission' would be unlikely. Headmasters of comprehensive schools probably vary in the criteria they use for entry into the sixth forms. If they did not limit entry, physical plant, expensive laboratories and so on, would not be likely to cater for the numbers. In general, science resources (teachers included) are always at a premium perhaps more so than the arts (Stenhouse 1968). However, it

must be accepted that there is a markedly large population of sixth formers in comprehensive schools. If this is so, probably it is, (though Neave does not say so) then proportionality is important. Neave does not account for proportionality which can be explained as follows:

There is a very large number of students in comprehensive school sixth forms. Of this large number, not all would wish, nor would be able, to enter science faculties in universities. Of those who wish to enter university, 36 per cent opt for science. On the surface, this seems to be a healthy state of affairs. But it fails to account for proportionality.

Of this already large number of students in comprehensive sixth forms because of open admission, only a small proportion of this large group may enter university. The 36 per cent therefore may be merely reflecting the large influx of total numbers into sixth forms. Open admission would enhance larger numbers coming into sixth forms and this would be reflected in actual numbers entering tertiary science education.

But the proportion of those wishing to enter university from these sixth forms may in fact be quite small. Neave does not appear to account for this. The proportionality problem has been discussed by Brian (1968):

> "Boys and girls in upper forms of our secondary schools are increasingly rejecting science as a field of study - the Report establishes this as a fact, supported by abundant statistical evidence. This bald statement needs some amplification as the situation is complex embodying several distinct trends. Thus -
>
> (a) More young people are staying on at school - the national sixth form is getting bigger all the time.
>
> (b) As a result of this general increase, the absolute number of pupils taking science is increasing.

> (c) Nevertheless the proportion of those staying on at school who take science is steadily declining, thus there is a relative decrease in science students."
>
> (Brian 1968).

Butcher (1969) also puts the situation clearly.

> "In terms of numbers, the swing has been relative, not absolute. Faculties of science have expanded, but more slowly than other faculties."
>
> (Butcher 1969).

There is also another important factor which does not appear to be given detailed attention by either Dainton (1968) or Neave (1973). Neave, in placing great importance to the 36 per cent entering science at university, does not account for future dropout rates as the student progresses in a science course. Nor does it account for those students, who after qualifying in science, do not continue in scientific occupations. Friedenberg (1959, 1961); Lewin and Sherwood (1971) have noted this. Butcher (1969) states:

> "It appears that in their subject the number of undergraduates studying for degrees in science decreases as their course progresses, but that the opposite applied to students of arts and social sciences."
>
> (Butcher 1969).

Neave's study could be also looked at from the point of view that if it was accepted that there is in fact a 'swing to science', a number of implications for science education would follow.

Firstly, present courses in this case, Nuffield courses, in science must be attracting students at secondary school. Therefore it would appear that there would be no need to change this successful curriculum. This however does not seem to be the case. A number of teachers who have attempted Nuffield science courses with students are highly critical of it. Martin (1970) outlines his

case:

> "Teaching is a highly personal art, and the good teacher must, and can only, work from a deep personal conviction. I believe it is useless for him to surrender his intellectual independence and 'toe the party line' ... In fact the very reason why Nuffield Biology is not more popular is that it is such an individual approach, that it does not in fact appeal to a wide range of teachers and pupils."
>
> (Martin 1970).

Ramage (1973) also criticises Nuffield Science in a similar fashion:

> "There is a very real danger that the prestige of the Foundation in other spheres, the frailities of human nature, and the pressures which will be exerted by numerous influential but unwise individuals and groups in the realms of education, will cause the projects, proposals to be accepted too readily and too widely. They would then be prescribed as 'the thing to do' and might even become 'status symbols' for schools. If such things occur, woe betide the heretics among teachers and unfortunate authors of books who do not toe the 'Party Line'. It would be bad for science too."

(The sense of this quotation was first published in 1964, and again in 1967 in the Times Educational Supplement.) The writer goes on:

> "My forecasts proved correct in remarkable detail and woe did betide the heretics, in several ways indicated in the second paragraph of the scientific freedom resolution. However the correctness of one's forecasts provided some compensatory comfort and more is coming with the turning of the tide in our favour. Much of 'Nuffield Science' already looks like an over specialised over elaborated evolutionary blind alley, excessively expensive for payers of taxes, rates, and fees who have had to provide for its implementation in schools. As for the pupils such a surfeit of science at schools could turn away more from continuing with it later than would be attracted to do so."
>
> (Ramage 1973).

Neave implies in his 'swing to science' that currently used courses are successful in attracting students. But other opinions regard these courses as not necessarily good courses. They are being held in high regard to some extent at any rate by

a tendency for teachers of science to follow fashion and to toe the party line.

In New Zealand, with centralised administration control of curricula in biology being held by the Department of Education, the situation outlined by Martin (1970) and Ramage (1973) is compounded. New biology in secondary schools is more than merely being 'the thing to do'. It is in fact compulsory. No choice of curricula or approach for teachers has been allowed. A teacher who for reasons of methodology, does not wish to adopt the prescribed approaches, is therefore more open to being regarded as being 'not competent', 'not responsible', or even 'disobedient' in New Zealand with its new biology courses, than in England and Wales with the Nuffield and other courses. The latter does allow for choice of alternative courses.

This situation, currently present in New Zealand is bad for biology. Biologists, teachers, curriculum makers and text writers hold that 'experiment' is important for science to improve. Yet to experiment with alternative courses at a pedagogical level is not held to be important. Apparently, it is assumed that all experiments by teachers of biology necessary to improve courses and approaches have already been carried out. The present pedagogical formula is the 'best' and only allowable one. To advocate experiment at a subject matter level as most important, and then to implicitly and explicitly muzzle the same procedure at a pedagogical level is paradoxical, and prevents any possible improvements in biological education. Moreover it may create an increased trend in a drift from biology.

Neave seems to be implying that an educational utopia has

developed in science. The above criticisms also serve to indicate that this is not the case.

Secondly, it seems that a 'swing from science' to a 'swing to science' can be invoked merely by applying the courses of comprehensive schools to all other schools, no matter the country. But in other countries a marked swing from science is observed. This does not appear to have occurred. A swing from science is occurring throughout the western world in spite of the type of course being used.

Thirdly, Neave implies from his findings that he could indicate causes of the swing not only from science but to science. He does not do this, except to imply that open sixth forms, and wider option systems may be causes of a swing to science. Other studies have shown that the causes are complex. Premature specialisation (Butcher 1969) may be a reason, disillusionment with the activities of science in general (Kranzberg 1972) may be another. Psychological and social factors also contribute. (Friedenberg 1959; Hudson 166, 1968; Cropley and Field 1968; Stenhouse 1971).

Thus there is a danger of accepting this study simplistically. Other evidence which is more comprehensive, disagrees with the notion that comprehensive school (and open sixth forms) systems will create a 'swing to science'. To take an obviously complex problem, and then maintain that it is really simple, would be to accept 'simplistic' notions. This is a dangerous position to adopt. In doing this Neave attempts to bring a great deal of established and reputable opinion on science education into disrepute. (For example Dainton 1968; Friedenburg 1961; Brian 1968; Butcher 1968; Doty and Zinberg 1968; Hudson 166, 1968; Osborne 1973; Thornton

1968; Kranzberg 1972; Ramage 1967).

Few science educators would accept the implications for Neave's research. His research findings may have significance for newly established comprehensive schools. But to claim that the findings are pervasively significant seems to promote 'hope' at the expense of 'fact'. Moreover, entry into New Zealand sixth and seventh forms is kept generally restrictive, although some relaxation of criteria for entry from fifth forms has occurred. Most schools in New Zealand would therefore resemble the selective schools of England and Wales, which were of the type sampled by Dainton.

The Dainton Report, because of its greater comprehensiveness, must be accepted as being more significant than that of Neave. In fact the parallel between Australia and the United Kingdom is very close.

> "The proportion of students entering science based faculties in universities in the United Kingdom in 1962 was 46.0 per cent; in 1966 it was 40.6 per cent. In Australia in 1962 it was 46.6 per cent; while in 1966 it was 40.6 per cent.
>
> Thus it seems that the 'drift' is not merely a local phenomenon, nor is it a passing one. Instead, it seems to be deep seated and pervasive."
>
> (Thornton 1969).

On this basis it seems likely that the situation in New Zealand will be little different from that in Australia and the United Kingdom.