(or the equivalent of other oestrogens) will usually provoke regular withdrawal bleedings, though it is relatively uncommon for cessation of treatment to be followed by regular spontaneous menstruation. Prolonged and irregular bleeding of dysfunctional type (which must first be proved by appropriate investigations) may be controlled by similar oestrogen therapy in many, though not all, cases. If bleeding is not arrested within 48 hours, the oestrogen dose should be doubled and maintained at that level for the rest of the 20-day course. If bleeding starts again before the course is completed, treatment should be stopped and resumed again five days later. After a regular menstrual cycle has been established, the oestrogen may be combined with an oral progestogen, given during the second half of the oestrogen course in the hope that this may lead to the occurrence of ovulation. Considerations of space preclude a more detailed exposition of the methods of treating dysfunctional uterine bleeding.

Dysmenorrhoea.—In the absence of pelvic disease this usually occurs only in ovular cycles, and the inhibition of ovulation by means of 20-day courses of oestrogen, beginning on the second or third day of the cycle, produces painless withdrawal bleedings. If such withdrawal bleedings are still painful, a wholly psychogenic basis for the dysmenorrhoea must be considered. In order to avoid the potential risks of prolonged inhibition of ovulation, it seems wise never to give more than three successive courses of treatment. The patient is then told to wait until she has another painful period, when a further three courses of treatment can be given, and so on. The dose used should be the lowest that will regularly inhibit ovulation: it varies from patient to patient, but is usually about 1.5–2 mg. of stilboestrol daily.

An alternative method, intended to obviate the drawback of inhibiting ovulation, is to administer a post-ovular course of oestrogen, such as dienestrol 10–15 mg. daily from the 15th cycle day for 10 days. There is no obvious rationale to this method, which, in the writer's experience, has only occasionally been an effective treatment for dysmenorrhoea.

Vaginitis.—In senile vaginitis, oestrogen-containing pessaries are the most convenient means of obtaining a local oestrogenic effect without the undesirable systemic actions. A pessary containing 0.1 to 0.5 mg. of stilboestrol is suitable, and may also be used for pre-pubertal vulvo-vaginitis. If, in small girls, insertion of the pessary proves difficult, the oestrogen may be applied locally as an ointment.

Suppression of Lactation.—It is now generally agreed that oestrogens do not inhibit lactation, but merely prevent the engorgement which follows cessation of suckling, itself the true cause of inhibition of lactation. Widely differing regimes have been successfully employed. In the Obstetric Unit at University College Hospital the standard dosage schedule is as follows: stilboestrol 5 mg. three times a day for three days, twice a day for three days, daily for three days, 1 mg. three times a day for three days, twice a day for three days, daily for three days. Good results have been reported with chlorotrianisene in an average dose of 4 capsules daily for seven days.

Palliation of Hormone-dependent Carcinomata.—The oestrogen treatment of carcinoma of the prostate was first introduced by Huggins 16 years ago. Stilboestrol has been most widely used, and high dosage—perhaps

excessively high—has been the rule. Since this treatment produces physiological castration, there seems to be no valid reason for employing surgical castration as well, though this is often done. The treatment is usually surprisingly well tolerated, though gynaecomastia, often painful, is an unavoidable side-effect.

In similar fashion oestrogens have been used for the palliation of inoperable carcinoma of the breast. They are most likely to be of value in post-menopausal women, but, as with other attempts at altering the endocrine environment, it is not possible to predict which patients will and which will not respond.

Miscellaneous Conditions.—In certain collagen diseases (for example, lupus erythematosus disseminatus, rheumatoid arthritis), at about the time of the climacteric the cyclic administration of small doses of oestrogen may lower the maintenance dose of corticosteroid remarkably, and so permit good control without the risk of side-effects.

In coronary thrombosis the use of oestrogens has been advocated because they lower the plasma cholesterol; clearly, the feminizing effects are a serious disadvantage. This objection is also true for the oestrogen treatment of severe acne in adolescent males, but it is less valid for the use of oestrogens in the treatment of uncontrollable sex urges. The individuals concerned here have mostly been homosexuals whose activities have brought them into conflict with the law, and who have felt unable to resist the temptation to further similar activities. Comparatively small doses, such as 1 or 2 mg. of stilboestrol daily, may suffice to damp down the sex urge to a level which no longer jeopardizes the patient's freedom, though the fundamental deviation of sexual outlook remains. It may be agreed that the testicular atrophy and gynaecomastia which must accompany effective oestrogen therapy are not too high a price for these unfortunate individuals to pay.

OPERATIONAL RESEARCH IN THE UNIVERSITY*

BY

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In this paper I am hoping to interest colleagues concerned with medical education in what has been called "operational research," the study of what goes on, of what happens to the student, and reciprocally to his university environment, as the two go through their course together. This is something different from the selection research with which many readers will already be familiar.

In the university some are becoming very doubtful of the value of selection research; or, at any rate, of selection research unaccompanied by operational research. As illustration, let us consider the standards expected in first-year examinations. It has been suggested that each faculty and department has its own unconsciously held norm of a proper casualty rate for the end of the first year, departure from which is regarded with discomfort. (The pass-rate differences

*Based on a paper read to the Inaugural Conference of the Association for the Study of Medical Education, 1958.

between departments are maintained with remarkable constancy year by year, a fact which suggests that the first-year examinations reflect something else besides variation in student ability.) It is suggested that when the failure rate is seen to be exceeding the traditional norm the marking is loosened, and borderline cases are given the benefit of the doubt. Where too many seem to be getting through, the marking is stiffened. Clearly the only consequence of improved selection methods in such a system is to improve the quality of the students one is going to chuck out. It is the first-year examination and the departmental procedures, not the selection of students, that are here in need of investigation; this would be operational research.

It is my view that quite a lot of selection research, though theoretically sound, is open to practical objections of this kind. It is as if, time and again, one was to set up, and bowl down, a collection of ninepins. By applying elegant statistical procedures one would discover that there were two independent variables which determined survival chances: width of the base, and weight of top relative to bottom. The statistical significance of the finding would be high; its practical importance would be low. It is the process of bowling that cries out for investigation. This is operational research.

But brave as that may sound, one must confess that the methodology yet available, as for much sociological work of this kind, is so primitive that it is still impossible to give firm answers to most of the things one would like to know. One spends hours designing questionnaires and collecting volunteers. One spends weeks and months getting results and punching them on the Hollerith cards, and endless ingenuity in contriving how best to sort the variables against each other. Yet in the end this enormous mass of paper boils down to one or two very small answers, and more often to one or two very big questions. There is no prospect of operational research procedures replacing the normal canons of common sense, human judgment, and teaching experience, upon which any medical education is based. Operation research must bear to teaching practice something of the same relationship that laboratory results bear to clinical practice. A leucocytosis and raised sedimentation rate are in no way a substitute for the clinician's diagnosis of infection. Operational research can be an aid to deanery, not a substitute.

In comparison with the enormous volume of work on selection problems, there has been very little systematic work on operational research published either in America or here. The American work consists of a great many small unconnected studies, mainly dealing with motivation and attitude development. As such, publication has been scattered through a very large number of American psychological journals. Much work there has also been done on learning, but the great majority of it relates to schoolchildren and to simple problems of memorization and rote learning rather than to the more complex business of university studies. The task of collecting together and reviewing this widely scattered literature would be enormous. No doubt much interesting information on methodology could be obtained, but I doubt whether the sum of published work would take us much further. There is a great variety of university institutions, and the isolated findings of one could not be added to those of another to give any consistent picture. An operational study

has to cover its chosen field fairly intensively. The only substantial American work with which I am familiar is the research on sociological studies in medical education carried out by the Sociology Department of Columbia University into the teaching programmes of Western Reserve and Cornell (Merton, Reader, and Kendall, 1957). There are also a number of valuable studies collected by Wedge (1958) at the Student Health Department at Yale University.

The work done in the United Kingdom is not large, but it does form a very valuable beginning. It was discussed at a conference on student performance held at University College, London, at the end of 1957, supported by the Nuffield Foundation, and attended by some 20 people actively engaged in operational studies. It is appropriate here to make brief mention of some of the work cited.

Furieux's Study

The largest recent study is that of Furieux, of the Nuffield Research Unit at the Institute of Psychiatry. Furieux tested large numbers of applicants to the University of Sheffield, categorized them by various methods, and has followed their progress over 10 years. He has been able to show that, within a given faculty, certain types of students may be expected to meet difficulties in part of their course and obtain low marks in the examination, say mechanical drawing; whereas students of another type will have their difficulty in another part, say mathematical engineering. He has begun to build up a picture of the general relationship between the type of work and the type of student. More recently he has had the opportunity of using these methods in other universities. Imperial College, London, for example, when worried about a high first-year failure rate, was able to enlist his help in finding out the different sort of difficulties students were meeting. All this work, by now very large in volume, is currently being written up, and we may hope for its publication in the near future.

Background Information

The University of Liverpool has recently made an important contribution to the prerequisites of operational research in collecting and publishing a detailed analysis of the academic achievement of students taken from the university records. Sir James Mountford (1956), the Vice-Chancellor, gives the failure and delay rates in the different faculties, and analyses them against awards, etc. With the increasing availability of such background data from different institutions, it should prove easier to recognize areas worthy of investigation. The University of Liverpool is continuing its studies, largely by retrospective questionnaires to ex-students.

Dr. Doris Thoday (1955, 1957a, 1957b) has done a series of studies with the students at Birmingham University. She developed a standard interview technique which obviates many of the disadvantages of retrospective questionnaires. As a result she has been able to publish several papers covering such questions as vacation work, varying hours of study in different years, the relationship of life in university residence to learning and to academic activities, and the like. Dr. Parnell (1954) at Oxford has studied the relationship of physique to different aspects of student performance. Dr. Still and Dr. Finlay, at Leeds Student Health Service, are also developing work along these lines.

Mention should be made of Mr. Dale's (1954) classic book in which he covers a great many of the problems of transition. Political and Economic Planning (P.E.P., 1950, 1954, 1955, 1956, 1957) have also produced a number of studies about subjects such as the source of grants of university students, and the opportunities for graduate employment, and the like which, if not in themselves strictly operational research in the university, are extremely important sources of background information. In a similar category is the very detailed study recently undertaken by Kelsall (1957) on behalf of the vice-chancellors' committee. Dr. G. Newfield in the Department of Sociology at the London School of Economics is intending to extend this work by following up a sample of Kelsall's students with questionnaires. Work by Warburton (1956) and by Davy (1957) is also of relevance.

Of great importance to both medical education and university practice in general are the studies of examination techniques which have recently been presented, particularly those of Bull (1956) at Belfast, and Lennox, Anderson, and Moorhouse (1957) at Glasgow. Of great pioneering interest, too, is the study of different teaching methods by Joyce and Weatherall (1957) at the London Hospital.

Studies at University College

Our own work in operational research at University College, London, began in 1954 when Irving Sarnoff, from the Department of Mental Health at the University of Michigan, came over on a Fulbright research fellowship for a year. After he left, John Hopkins took his place, and we had the support, for two years, of the Halley-Stewart Trust, and since then of the Medical Research Council (Hopkins, Malleon, and Sarnoff, 1958; Malleon, 1958a, 1958b; Hopkins, 1959).

Just as there is not space in a paper such as this to review all the relevant literature in this field, there is not room to discuss all the methods available, and the pros and cons of their application. Instead I am going to give two extracts showing the sort of work that can be done. These should be regarded not as finished studies but as titbits to stimulate interest.

The first example is picked out of two retrospective questionnaire studies we have done at University College. One covered four years of entry, 1948-51, wherein we sent questionnaires to all the students who had failed, and to a selected control sample who had graduated. The other was confined to the 1953 entry, but it was here comprehensive, and the material was drawn not only from postal questionnaires, to which 86% of the ex-students replied, but also from everybody's college records.

Now it is well known in most senior common rooms that the grants system is one of the troubles of the modern university. Of course, there is nowadays a high failure rate and a high breakdown rate. With the help of grants children are coming up to university through the grammar schools from home backgrounds to whom a university education and academic approach are a complete novelty. Such children come from schools where they are big cocks on little middens, and are thrown into the competition of the university, particularly finding themselves up against boys and girls from the public schools whose home backgrounds, sometimes for generations, have incorporated traditions

of university or professional education. Table I is therefore of peculiar interest. It shows the academic performance of those who come from "grammar schools" (here used to cover State-supported schools),

TABLE I.—*Schooling and Academic Achievement (Home Students, Under 23 Years Old at Entry)*

	Graduated	Got 1st Hon. (% of Graduates)	Failed (% of Entry)
Grammar	310	39 (12.5%)	41* (11.7%)
Independent ..	62	4 (4.8%)	22* (26.2%)
Other	38	1 (2.2%)	7 (15.5%)

* $P < 0.01$.

and the "independent schools" (here used to cover fee-paying schools, in practice so-called public schools). It will be seen that, far from being the lame ducks, those from grammar schools have a failure rate of 11.7%, whereas privately educated students, drawn primarily from the middle class, have a failure rate two and a half times as great. The grammar schools get more first honours degrees, but the numbers here are smaller and the statistical significance is less.

Now, these are remarkable figures indeed; they have surprised many academic colleagues. But they are open to a great many interpretations. I suspect the truth is a combination of several. A most obvious possibility is that the better public-school boys more often apply to and are accepted at the classical universities. Our figures alone cannot throw much light on this. In the questionnaires we asked which was the first choice of university, and we analysed this against the failure rates. Table II shows that the differential failure rate between

TABLE II

	First Choice London			First Choice Elsewhere		
	Total	Failed	Failure Rate	Total	Failed	Failure Rate
Grammar	212	21	10.0%*	87	4	4.6%
Independent ..	52	13	25.0%*	16	3	19.0%

* $P < 0.01$.

schools remains irrespective of university choice. It shows also that the great majority of our students, in fact, have come to the university of their first choice. Our independent school entry does not appear to be a reject from Oxbridge. This may reflect simply that the applicants have had realistic advice about where they are likely to be accepted, and have not aspired too high. Of those whose first choice was elsewhere (Oxbridge in the enormous majority), there is the same differential, but some support for the idea that the very best may seek acceptance at the classical universities, for the failure rates are in both cases smaller (the numbers here are, however, too small for any great degree of confidence).

We have plenty of evidence that this differential failure rate is not a spurious finding of the 1953 entry.

TABLE III

	Public/Private Schools	Grammar Schools	Other
Failed group (N=176) ..	77 (43.7%)	84 (47.7%)	15 (8.6%)
Control .. (N=211) ..	63 (30.2%)	140 (66.0%)	8 (3.8%)

For example, the earlier 1948-51 study showed a similar pattern. Table III illustrates this, the "control group" here being a broadly matched group that graduated successfully.

Of the other possibilities that might contribute to this finding, I would illustrate just one. Table IV suggests that failing students are more often uncertain about

TABLE IV.—*Confidence in Decision on Intended Career*

	Little	Great or Average	Not Stated, etc.
Failed group (N=176)	32 (18.8%)	84 (47.5%)	60 (33.7%)
Control " (N=212)	22 (10.3%)	132 (62.2%)	58 (27.5%)

coming to college in the first instance. This, of course, is a retrospective finding, and may to some extent be an *ex post facto* justification for failure. But we have other evidence suggesting that uncertainty and ambivalence in application for admission and career choice correlate with poor performance. Table V suggests that

TABLE V.—*Students' Attitude on Application*

	Keen	Against	Uncertain	% Uncertain or Against
Grammar ..	244	5	50	18.3%*
Independent ..	46	3	20	33.3%*
Other ..	26	1	11	29.4%

* $P < 0.02$.

independent schoolchildren show this uncertainty more than their grammar-school confreres. There is, from our questionnaire, other evidence which would bear out a supposition that the independent-school boy, even though doubtful himself whether to go to university, comes under pressure, sometimes overt, sometimes covert, from parents or teachers, and perhaps from his general social environment. The grammar-school boy, in whose circles going to university is not so normally prescribed, is less often so pressed.

Students' Stresses and Strains

Findings of this sort, no one conclusive by itself, paint a picture perhaps in keeping with one's common-sense knowledge of present English society. The middle and professional classes are under increasing competition and pressure, both financially and socially; this pressure is felt by the undergraduate as he comes up, having almost to keep a flag flying. Stresses and difficulties that he may meet in his course may therefore press him the more. Such ideas are too sketchy at present to convey any infallible message to the medical school authorities, but even in their crude state they carry two implications. The first is to selectors, that they should beware lest they are selecting a worse public-school applicant before a better grammar-school child because he has "interviewed" better. The second, and to me infinitely more important, is to say to those in charge of the students who are selected, "Watch your public-school boys most carefully. They are the ones under greatest pressure from society and may therefore need the most help."

The second example is taken from an unpublished study we did on our 2nd M.B. students coming up to the examination in March, 1957. I have chosen this because it well illustrates how this sort of work will give you more questions than answers. Most studies on examinations are inevitably retrospective, but on this occasion we were able to get the students to complete the questionnaires after they had sat their papers and some of their practicals, but before the final vivas and results were known; we enjoyed the very willing

co-operation of the Medical Sciences Faculty and the most good-hearted help from the students who volunteered to a man. We drew up what I felt was a splendid questionnaire. It covered all the areas of motivation in which I was interested, and asked questions about examination nerves, sociability, and personal history in the university. The entire lot was filled in, and in high expectation we coded and punched them and fed the blocks of cards into the machines.

TABLE VI.—*University College, London: 2nd M.B. Survey, 1957 Schooling*

Description of School	Top 25%	Bottom 25%
Grammar ..	12	9
Independent ..	5	9
Direct grant ..	1	1
Overseas schools, etc. ..	2	1

The results were nothing—or almost nothing. There was the expected difference in schooling as shown in Table VI. There was an interesting comment on pre-examination strain as shown in Table VII. A very large proportion of students felt that strain was actually impairing their working efficiency, particularly in the 2nd M.B. term. One interesting little finding, completely in accord with one's clinical experience, was that strain particularly clustered into the upper and

TABLE VII.—*University College, London: 2nd M.B. Survey, 1957 Reports of Psychological Strain Sufficient to Impair Efficiency (N=79)*

	October Term	Current Term
Reported strain ..	18 (23%)	32 (41%)
No strain ..	57 (72%)	46 (58%)
.., reply ..	4 (5%)	1 (1%)

Distribution of Psychological Strain, Current Term (N=32)

	Reporting Strain	Not Reporting Strain
In top and bottom quartiles ..	21	19
In middle quartiles ..	11	29

 $P < 0.05$.

lower quartiles. It was the excellent student with high aspiration, hoping to read a B.Sc., and the poor student who knew he was likely to fail, who were the most troubled. The middle quartiles who knew they were safe for a pass—unless they got a stinker of an outside examiner—were not so worried. All the other items in the study absolutely failed to reveal any significant difference between the good and the bad students, the failed and the successful.

Private Study

But the really interesting part of the study was found in the answers to questions about private study. Both in the term before the examinations, the period immediately preceding them, and on the evenings of the examinations themselves, we found no consistent differences between good and bad students in the amount of private study reported. Tables VIII and IX show this. Although the assessment of the time spent in study was retrospective, I am fairly confident of its accuracy in that it accords very closely with the findings of Doris Thoday (1957a) at Birmingham. She used a much more sophisticated method of determining study periods. She interviewed large numbers of students of different faculties on

TABLE VIII.—*University College, London: 2nd M.B. Survey, 1957*
Hours of Private Study Reported (per Week)

	October Term (N=61)	Current Term (N=66)
Mean	19 (18)	30 (31)
Range	3-60	10-60
S.D.	13	10.3
Thoday's survey mean	19.5	28.0

Failed students' averages in parentheses.

TABLE IX.—*University College, London: 2nd M.B. Survey, 1957*
Hours of private study reported immediately before the examinations (papers on Monday, Tuesday, and Wednesday)

	Previous Week (N=74)	Sunday (N=76)	Monday (N=78)	Tuesday (N=78)
Mean	54 (54)	5 (5)	3 (3)	2 (2)
Range	12-90	0-18	0-9	0-6
S.D.	14.3	3.7	1.8	5.4

Failed students' averages in parentheses.

different days of the week and had them detail what they had done the previous day. Table VIII shows the closeness of agreement.

I found it surprising enough that there were no consistent differences in the hours of study between good and bad students; I found it more surprising that there was such an enormous range of difference between individuals. This is shown in Tables VIII and IX. Both the best and the worst students were scattered indiscriminately over this range. It is indeed interesting to question why this should be. How is it that one young man, selected on much the same criteria as another, does five times as much study and yet gets considerably lower marks? One can hardly feel convinced that he is five times less intelligent; he passed the same examinations before acceptance. I suspect that the answer lies in differences of study technique. The truth is that after primary school or prep school we never teach how to learn; certainly at university techniques of study are not taught. They are not taught because we do not know them. How many hours of reading represent the optimum? What is the most efficient way of reading—continued attempts at recall or to read straight through? Are detailed notes, kept and recopied, essential, or are they time-wasters? If there are variations between students, what determines them? Is the ectomorphic introvert different in his optimal study requirements from the mesomorphic extrovert? We do not know these things; what hours of wasted study time might be saved and put to better use, academically or extra-curricularly, if we did.

Conclusion

If I have succeeded in interesting any reader in operational research, here is a ready field in which to begin. And I hope I have interested someone, for he will find the work fascinating. Of course, he will draw many blanks; he will also find many delightful irrelevancies—that the students who sit in the front two rows at lectures get better degrees than those who sit at the back—that those who take first honours are more often married than those who take thirds. But amid the negatives he will, if he is lucky, draw out material of real value to medical education.

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VERITAS*

EXAMINATIONS AT HARVARD MEDICAL SCHOOL IN 1958

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Much has been said about the need for integration between the preclinical and clinical courses for medical students and the need to clear away the cobwebs in both courses. Much has been said about the need to teach students not only from a basis of fact rather than impression, but also so that they may understand and later more readily apply advances when they have become doctors. With each year more science enters the curriculum, and the trend with increasing knowledge is, as for many years, away from "art," though art must remain where science cannot be exactly applied, such as in bedside manner and individual management.

In the United States more efforts than in this country have been made in some medical schools towards integration and the emphasis on science. Perhaps the medical school where the greatest change has been made is still the Western Reserve Medical School in Cleveland, Ohio, but Harvard Medical School is fast working in the same direction. The student has spent four years at a university before entering Harvard Medical School. During the first two of these four years the education for most has been general, and only in the second two years do the courses contain basic science; in this latter period some may have taken more advanced courses in, say, biochemistry or biophysics, though it might equally be in sociology or anthropology. The course of study at the Medical School is also for four years, and the time spent on some subjects may seem shockingly short compared with that traditionally spent in this country. Thus

*This word appears on the Harvard University coat-of-arms.