undertaken before the patient's clinical state has had time to deteriorate, while a negative finding means that the presence of a serious internal injury is unlikely.

The technique of introducing a pliable catheter into the pouch of Douglas appears free of major hazard unless there are extensive abdominal adhesions. It has the added advantage that if peritoneal dialysis is needed, as in the dialysis treatment of acute haemorrhagic pancreatitis, the catheter can be left in position. Finally, if there is still doubt after a negative finding in the pouch of Douglas the catheter can be manipulated gently towards the spleen or liver and a small dialysis wash-out performed in these regions.

The success rate of this series with respect to obtaining a positive result when disease was present and a negative one in the absence of disease, as well as a comparative lack of false-positive and false-negative results, was very rewarding and much higher than that reported in earlier series when a simple needle aspiration technique was used.[7] The incidence of false-negative results was significantly lower than the 10% previously reported.[2 8] The improvement in the result is presumably due to the technique and materials used—that is, using a catheter long enough to reach into the pouch of Douglas and which is firm enough to be directed there. Washing out the area with a dialysate solution in order to recover even small quantities of exudate is also an advancement in the technique. With these improvements a negative finding has achieved greater significance and in our hands has led to an appreciable reduction in the need for exploratory laparotomy.

Fears have been expressed about the danger of damaging a viscus.[9] While this may have been a real hazard when spinal needles or glass tubes were used, with modern synthetic materials, which are both flexible and pliable, it was apparent that this risk has been much reduced. This accords with our own experience of repeated peritoneal catheterization for peritoneal dialysis, in which patients have had repeated catheterizations, sometimes extending over a period of several years, for treatment of renal failure without any complication of this kind.

The findings of abdominal paracentesis, however, cannot be considered on their own but must be taken into consideration along with the patient's history and clinical condition. A negative finding in patients with pains arising de novo does not necessarily exclude abdominal disease; it merely means that the visceral peritoneum is not inflamed and so not generating any exudate. Such patients should be watched carefully and if necessary the abdominal catheterization repeated if the clinical condition continues to warrant this. From the results presented, however, it is clear that abdominal paracentesis is a useful diagnostic aid and not infrequently prevents patients having an unnecessary laparotomy. Equally important is that where an early diagnosis can be made the appropriate surgical treatment can be started immediately, before the patient's clinical condition has had time to deteriorate.

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Work in Progress

Medical Research Unit in a District General Hospital

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In June 1946 the half-million people of Stoke-on-Trent and its environs were served by six separate hospitals staffed by 30 consultants and 30 junior staff. In 1971 an integrated hospital centre of 1,500 beds on one single campus was staffed by 86 consultants and 120 junior staff. This expansion, paralleled elsewhere in the Health Service, involved the creation of specialized units such as for neurology, neurosurgery, thoracic surgery, and cardiology, a renal unit, a coronary care unit, and units for rheumatology and gastroenterology. The additions to the consultant staff coupled with retirements have resulted in an average age among consultants being in the mid-40s.

In the first 10 years of the National Health Service postgraduate medical activities in Stoke-on-Trent were the province of the local medical society. It soon became apparent that the future medical scene would be highly competitive in terms of staff at both senior and junior levels. Monthly clinical meetings held in the nurses' lecture hall borrowed for the occasion would clearly not meet the need. Therefore in 1959 a public appeal sponsored by Sir George Wade was opened with the aim of obtaining funds to build a medical institute which would encourage both postgraduate education and medical research. With £100,000 raised by the appeal the North Staffordshire Medical Institute was built and opened in 1963 and provided a lecture hall, library, and ancillary facilities.

The Institute was the prototype of many subsequent postgraduate institutes in large district general hospitals and paved the way for a two-phase development in postgraduate activities—that is, postgraduate education and clinical research. Since the concept of an active research unit was so dependent on the initial establishment of a successful system

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of postgraduate education it is desirable to describe the two-phase development in some detail, as this may prove of value to other large district general hospitals evolving their own postgraduate research programme.

Postgraduate Education

Before 1965 postgraduate teaching was organized on the basis of teaching rounds and an annual two-week course with local and invited speakers of national reputation. After 1965, with the expansion of already available facilities and the introduction of the specialized units, a rotational scheme was devised for junior staff at senior house officer and registrar levels in the surgical and medical departments. In the medical department, for example, there are now three streams of senior house officers who rotate over a 16-month period at four-monthly intervals through cardiology, neurology, and two other specialties selected from general medicine (diabetes, respiratory disease, nephrology, endocrinology, haematology, and dermatology combined with rheumatology), together with supervised medical emergency duties arranged on a rotational basis. A similar rotational system operates in general surgery, thoracic surgery, neurosurgery, plastic surgery, and orthopaedic/accident surgery and meets the training requirements of the Royal College of Surgeons.

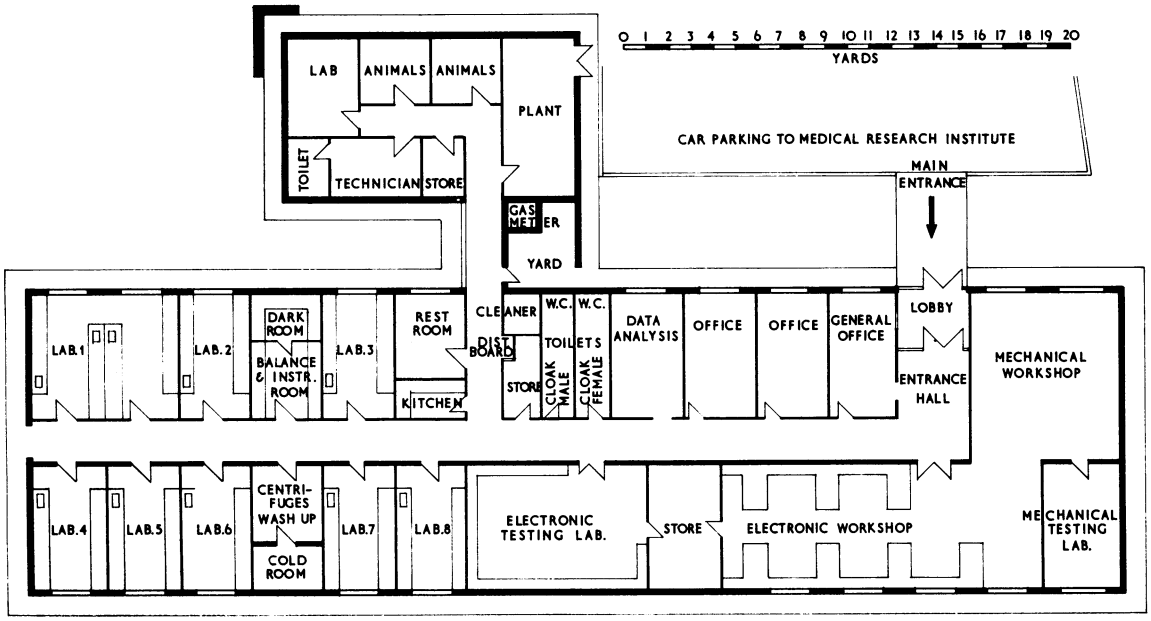
Within these specialized units senior house officers act as house physicians and surgeons and are subjected to continuous supervised postgraduate teaching. This is supplemented by a planned consultant teaching round three times a week, a weekly clinical staff round in medicine and surgery, and weekly clinical meetings within the specialized units. This is further supplemented by day symposia on selected topics held six times a year aimed broadly at the consultant and research grade. They are delivered by experts in their field and attended by all hospital junior staff. The aims of such a scheme were to streamline young graduates through their higher examinations, as this is still regarded as an obligatory passport to consultant training, and to expose each graduate to the disciplines of a wide variety of specialized departments, thereby helping him in his ultimate choice of a vocational medical or surgical specialty. The success of the scheme in the medical department is shown by the fact that out of 43 graduates who have completed training over the past eight years 37 have obtained their Membership; over the past four years the length of time between registration and gaining the Membership has been two years three months.

Postgraduate examination success is a limited aim, and if this were the end-point of postgraduate development it would rightly be condemned as banal. Nevertheless, it is the foundation stone of an actively developing postgraduate centre on which the superstructure of a proper postgraduate organization concerned with teaching and research can be built.

Establishment of Research Unit

The absence of research facilities in a large hospital complex is a serious problem to all medical staff. It has been correctly stated many times that it is desirable for medical research to continue after consultant establishment. In the average teaching hospital backed by the various disciplines of a medical school there is usually no problem in achieving this end, and it is dependent on individual desire or individual ability whether or not research continues. Most of the consultant staff in a large district general hospital have been trained in teaching hospitals, have been exposed to medical research, and have themselves carried out research. The fact that such staff should have elected to take up positions outside teaching hospitals does not imply that they have abandoned their interest in research. It is common knowledge among regional consultants that the absence of adequate research facilities causes frustration at a time when men in their middle and late 30s are at their professional peak with regard to ideas, enthusiasm, and the understanding of scientific methodology. A wealth of clinical material is available to them and yet they find themselves unable to pursue their academic interests.

The assumption that sophisticated research is the prerogative of the teaching hospital must surely now be an outmoded one. Most medical staff in Britain work in "non-teaching hospitals" which are responsible for the hospital treatment of most of the population. In addition the work is unselected and therefore more representative of disease pattern in the community as a whole. Until facilities are provided or obtained for research in the large district general hospital the terms "teaching" and "non-teaching" hospitals will remain and while they remain will imply, to the ear trained to detect such nuances, a different level in the quality of clinical practice.



Layout of medical research unit in a district general hospital.

The absence of such research facilities also has an influence on the use of district general hospitals as postgraduate training areas and centres. The problems are crystallized in the report of the Royal Commission on Medical Education headed by Lord Todd, where it is suggested that in the course of general professional training one year spent in research might be profitably carried out in the second or third years of general training before specialty training. With the various higher examinations completed career graduates commonly wish at this stage to undertake specialist training, and it is essential that research facilities should be available to them.

Research Unit in Stoke-on-Trent

The idea of a research unit was implicit in the original development of the medical institute at Stoke and was regarded as the natural progression in the development of an active postgraduate school. The planning of the unit culminated in a further public appeal, which was launched in March 1969 and was titled the "Lord Lieutenant's Appeal"; the chairman of the fund-raising appeal was the Lord Lieutenant of Staffordshire, Mr. Arthur Bryan. Grants were received from the Birmingham Regional Hospital Board (£40,000), Staffordshire County Council (£10,000), and Stoke-on-Trent Corporation (£6,000). Many of the donors of covenants for the original institute appeal responded generously and renewed their covenants for a further seven-year term, and by this means a further £20,000 was raised. The remaining £24,000 was raised by efforts of Rotary Clubs, Round Tables, Inner Wheels, working men's clubs, women's institutes, and individual members of the community. The appeal was closed on 18 September 1970, when the target of £100,000 was reached. Before the appeal was launched a detailed survey was carried out among all medical members of the institute in relation to research needs, both immediate and long term, and an analysis of this data determined the distribution of space within the research block. The building is a single-storey block (see Plan) of 8,700 ft² (800 m²) adjacent to the medical institute and within the hospital campus. The research unit was opened in June 1971 by Her Royal Highness, Princess Margaret.

Facilities Provided by Unit

Laboratories.—The research unit contains eight all-purpose laboratories occupying 3,000 ft² (280 m²). These areas designed specially as a balance and instrument room, a dark room, and a cold room (see Plan). Though certain basic equipment will be provided for common use it is expected that specific items of equipment relating to any particular project will be provided by the research group involved in that project. Provision of technical help other than a chief technician will be the responsibility of the individual research teams and will not be supported by research unit funds. There are already departments requiring space that are at present working under difficult circumstances elsewhere in the hospital centre. One important purpose of active laboratory research is to provide opportunities for members of the junior medical and non-medical staff to be trained in research disciplines and so obtain higher degrees.

Data Processing.—Facilities and equipment for data processing (1,450 ft²; 135 m²) are provided in the research unit which will be linked with the main hospital computer currently being introduced into the North Staffordshire Hospital Centre. Two systems analysts, who are also members of the main computer team, have been appointed to give advice in the initial design of clinical and scientific investigations and to help provide suitable methods for recording and analysing the clinical and experimental data.

Animal House.—An area of 1,250 ft² (116 m²) is provided for housing and carrying out experiments on small animals. This complements the facilities already available to members of the hospital staff in the Dunn Cardiac Surgical Research Unit in the biology department at Keele University, which houses large animals. Responsibility for the salary of an animal house technician is borne by the research unit.

Bioengineering.—Bioengineering (3,000 ft²; 280 m²) covers such a wide field of interest common to medicine and the applied sciences that probably it cannot be defined precisely, but there can be no denying that recent advances in technology have and will continue to play a major part in patient care. Two years ago the North Staffordshire Polytechnic and the hospital management committee agreed to establish a joint department of bioengineering which would be responsible for the development of new equipment and techniques related in the broadest sense to the improvement of patient care. It was emphasized that this department would not be responsible for day-to-day servicing and maintenance of hospital equipment—which would remain a commitment of the hospital engineering department—but there would be free interchange of ideas and personnel between the two departments. The bioengineering unit is already engaged in active research projects with clinical departments in the hospital centre and is providing opportunities for research graduates from the polytechnic to obtain higher degrees.

Secretarial assistance.—Two secretaries are available to all research workers; a further two secretaries are entirely concerned with the data processing section.

Current Projects

Initially laboratory space will be allocated to existing research projects which are being carried out under far from ideal circumstances within the hospital centre. Personnel involved include consultant and junior medical staff and research fellows with appropriate technical help. All receive financial support, mainly from the Birmingham Regional Hospital Board but also from specifically designated institute research funds. Current projects include (1) manifestations of intravascular coagulation associated with surgical, renal, and obstetric problems; (2) metabolic changes in the cerebrospinal fluid in cerebral vascular disease; (3) amino-acid metabolism and nutrition in renal disease; (4) studies of immunological aspects of industrial bladder tumours and studies on methods of early diagnosis of these tumours; (5) metabolic studies on peripheral nerves in hypoglycaemia; and (6) immunosuppressive therapy in renal disease. Other research projects requiring large animals and other facilities are also being carried out at Keele University and within the hospital centre.

Though the North Staffordshire Biomedical Engineering Unit, financed jointly by the North Staffs Polytechnic and the North Staffs Hospital Management Committee, has been formally established during the past three years collaborative research and development projects, mainly in the field of orthopaedics, have been carried out for almost 10 years. The unit, when current vacancies have been filled, will have an establishment of five senior research staff, four research assistants, and 11 technicians. Members of staff of other departments of the polytechnic are also engaged on research projects of biomedical engineering interest. The research content of the unit's activities is now undergoing some expansion to include projects aimed at a better understanding of biological systems in addition to those concerned with the development of equipment and techniques related to clinical problems.

Current research and development projects include the following topics: (1) the optimum conditions for reduction and fixation of subcapital fractures of the femoral neck; (2) the measurement of swelling, biochemical changes in oedema fluid, and the biomechanics of stiffness in relation to

hand function after trauma; (3) the evaluation of the mechanical properties of bone tissue with particular reference to drilling and cutting; (4) the surface acquisition of atrioventricular electrical activity; (5) the measurement of thoracic impedance during D.C. defibrillation; (6) the physicochemical factors influencing platelet aggregation and adhesiveness; and (7) an ultrasonic method of emulsifying eye lens tissue.

Administration

The research committee of the North Staffordshire Medical Institute has administrative responsibility for the general organization and running of the research unit. On this committee serve representatives of the hospital medical staff, the North Staffordshire Polytechnic, general practitioners, workers in industrial health, dentists, pharmacists, opticians, and local industry. Executive decisions relating to the day-to-day running of the unit are the responsibility of the chairman, secretary, and treasurer of the research committee.

The scrutiny of the detailed applications for facilities within the research unit research projects is undertaken by two subcommittees of the main committee—one concerned with engineering and the other with clinical projects—which are all submitted to the hospital ethical committee. These committees advise prospective research workers on specific scientific or financial problems where appropriate and suggest suitable external guidance when the scope of the work falls outside their experience.

The day-to-day cost, as with the medical institute itself, is borne in the major part by the hospital management committee. The financing of individual research projects will, as in the past, be the responsibility of the appropriate research group.

Conclusion

The building of a research unit of the type described must be regarded as an experiment since so far as we know it is the first of its kind in a district general hospital. We believe, however, that it is a justifiable experiment based on the belief that it is a natural and necessary development within a modern general district hospital and will ultimately prove, as did the medical institute itself, the prototype for many that will subsequently follow.

The current development in the hospital centre has been made possible only through the total involvement of the whole consultant staff. On their behalf we thank the Birmingham Regional Hospital Board, the Council of the Institute, and the North Staffordshire Hospital Management Committee for their continued encouragement. A debt of gratitude is owed to Mr. Arthur Bryan for his vigorous leadership and to Mrs. Leslie Barker for her generous voluntary help as secretary of the appeal. The architects were S. M. Cooke and Partners of Birmingham.

Any Questions?

We publish below a selection of questions and answers of general interest

Intradermal Cholera Vaccine

What is the recommended intradermal dose of cholera vaccine?

The intradermal dose of cholera vaccine is usually 0·1 ml. Noble[1] found that the protection afforded by cholera vaccine administered by the intradermal route, as demonstrated by active and passive mouse protection tests, active guineapig protection tests, and agglutination titres, is excellent and equal to that obtained with subcutaneously administered vaccine. No reactions occurred after intradermal vaccination, but he estimated that 10% of patients have local or general reactions after subcutaneous administration of the vaccine.

The protective efficacy of intradermal vaccination has not been determined under field conditions, however, and no valid conclusions can be drawn about the relationship of the laboratory potency tests to field efficacy. The vaccines used for purposes of the International Certificate of Vaccination must contain 8,000 million *Vibrio cholerae*, Ogawa and Inaba classical biotypes, per ml.

Unfortunately, the advice issued[2-5] on the dosages and intervals between injections of cholera vaccine varies considerably, as shown in the Table.

1 Noble, J. E., *Journal of Hygiene*, 1964, **62**, 11.
2 *British Pharmaceutical Codex*. London, The Pharmaceutical Press, 1968.
3 Ministry of Defence. *Memorandum on Immunological Procedures*, 4th edn. London, H.M.S.O. 1968.
4 Department of Health and Social Security, *Immunization against Infectious Disease*. London, H.M.S.O. 1968.
5 Advisory Committee on Immunization Practices, Recommendations. *Morbidity and Mortality Weekly Report*. U.S. Department of Health Education and Welfare. Washington, 1969, **18**, No. 43, Supplement.

Recommendations on Route of Administration, Dosage, and Interval between Doses of Cholera Vaccine

Authority	Route of Administration	Age of Patient (Years)	Dosage		Interval (Days) Between Doses
			First	Second	
British Pharmaceutical Codex[2]	Subcutaneous		0·5 ml	1·0 ml	7-28
Ministry of Defence[3]	Subcutaneous	Over 5	0·5 ml	1·0 ml	7-28
		1-5* years	0·25 ml	0·5 ml	10-28
	Intradermal	5 years+	0·1 ml	0·1 ml	10-28
		1-5* years	Not recommended		
Department of Health[4]	Not stated		1·0 ml	1·0 ml	7-14
U.S. Advisory Committee[5]	Subcutaneous or Intramuscular	Over 10 years	0·5 ml	1·0 ml	Over 28
		5-10 years	0·3 ml	0·5 ml	Over 28
		Under 5 years	0·1 ml	0·3 ml	Over 28

*Vaccination under 1 year not recommended.