THE ROCK CARLING FELLOWSHIP

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The Sanguine Mystery

'THIS BLOODY AND BUTCHERLY DEPARTMENT OF THE HEALING ART'

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Sir Charles Illingworth
CBE, FRCS, DSc, Hon LLD
Emeritus Professor of Surgery
University of Glasgow

THE NUFFIELD
PROVINCIAL HOSPITALS TRUST
1970

Designed by Bernard Crossland
PRINTED AND BOUND BY
HAZELL WATSON AND VINEY LTD
AYLESBURY, BUCKS

The Rock Carling Fellowship
was founded as an annual memorial
to the late Sir Ernest Rock Carling,
for many years a Governing Trustee
of the Nuffield Provincial Hospitals Trust
and Chairman of the Trust's Medical
Advisory Committee.

Each holder of the fellowship
will seek to review in a monograph
the state of knowledge and activity
in one of the fields in which Sir Ernest
had been particularly interested and which
is within the purposes of the Trust.
The arrangements provide that the
monograph will be introduced by a
public lecture to be given at a
recognized medical teaching centre
in the United Kingdom.

PREFACE

Ernest Rock Carling was born in 1877. He received his medical education in London and served as Surgeon to the Westminster Hospital until his retirement in 1942. He died in 1960.

I first met him in 1944 at a meeting convened by the Nuffield Trust, of which he was a member, and I soon learnt to admire his ability. He had always been a man of wide interests. His surgical approach to the problem of cancer had led him to explore the therapeutic possibilities of radium and he was an early member of the Radium Commission. The loyalty which London hospitals more than any others seem able to inspire led him to take a prominent part in planning the new Westminster Hospital which took shape in 1938. He continued to educate himself long after the age at which many men go into retirement. He was nearly seventy years old when the discovery of radio-isotopes brought a vast new science to bear upon medical problems, yet he quickly assimilated this strange new field of knowledge to the extent that he soon became consultant adviser to the Atomic Energy Authority and chairman of its committee on protection against ionising radiations.

But particularly I remember Rocky as a person, his slim neat figure, sprightly and perennially youthful, his small but impressive presence, the enquiring tilt of his head, his gentle questioning look, the welcoming smile of his thin mobile lips, his quiet capacity for self-effacement in the service of others. In his day he took some part in moulding the character of surgery in this country, and by his example he must have done much to mould the character of younger surgeons. It is a great honour to be invited to contribute this monograph in his memory.

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Introduction

In the year A.D. 1215 Pope Innocent III evoked the ancient principle 'Ecclesia abhorret a sanguine' to prohibit his clergy from exercising the profitable trade of blood-letting and so established the distinction between priestly physicians and profane surgeons, between a cultivated exercise and a crude craft, between the sombre profession of medicine and the sanguine mystery of surgery.

But although thus relegated to inferior status, surgery could at least claim priority in date of origin, for long before the dawn of history the surgical treatment of wounds must have been undertaken; even earlier than the psychiatric administrations of the witch doctor and certainly many millennium before the advent of rational medicine.

Indeed, in terms of the long history of life on earth the rational approach to medicine is a very recent development indeed. The earliest forms of life are believed to have appeared more than two thousand million years ago. The great saurians roamed over the earth a mere hundred million years ago. Man's most primitive ancestors flourished less than two million years ago. If we compress this whole unimaginably long period into a single twelvemonth we see that homo sapiens did not arrive upon the scene until 10 o'clock on the evening of 31 December, that civilization, beginning perhaps in Mesopotamia some 10,000 years before Christ, only arrived within the last five minutes of the year, Hippocrates within the last minute, and every modern invention including anaesthesia, antiseptic surgery, and antibiotics within the last few seconds.

Modern surgery, indeed modern medicine too, may be said to have started with Joseph Lister. The sub-title 'This bloody and butcherly department of the healing art' is Lister's own description of the scene as he saw it in his early days. Prior to 1865 surgery had advanced but little since biblical times; physicians still bled and blistered for all manner of ailments; and in the lying-in wards Mrs Gamp still ruled supreme. Joseph Lister not only opened the way to progress in surgery. He encouraged others to study bacteria as agents of disease and to seek their antidotes. Hence Koch and Ehrlich, Fleming and Florey, and all who followed in the same path.

In the field of surgery even during my own time as a teacher the progress has been unprecedented. Forty years ago surgical teachers were much occupied with diseases caused by micro-organisms; pyogenic infections, septicaemia, pyaemia, tuberculosis, syphilis, and infective conditions in every part of the body. Now all these conditions have been brought under control. But in their place have come other diseases, some of them new afflictions like cancer of the lung, others old diseases like atheroma which can now sometimes be treated by operation; and whole new departments have emerged, like cardiac surgery and the surgery of transplantation. And there has been progress in another sense, for in every field there is increased attention of the quality of surgical care, and to the aim of not merely conducting the operation in safety but restoring the patient as far as possible to healthy enjoyment of life.

Can we predict similar progress in the next forty years? Or will new diseases appear, more devastating than in the past? Will cancer follow tuberculosis out of the surgical texts and into the history books? Or will tuberculosis return in resistant form and even more terrifying aspect? Will new viruses appear and repeat the poliomyelitis tragedy? Will bladder stone, once so

common and now so rare, return again? Will gallstones continue to increase?

Of more immediate importance, we must ask ourselves what we can do to advance our craft? We must turn our thoughts to the methods and techniques of surgery, some of them modernized but others little changed since our grandparents' days. We must consider the hospital facilities and staffing arrangements which are necessary for the proper performance of our work. We must consider the members of our craft and the kind of training they need. But before all these mundane considerations we must review the ultimate purpose of surgery, and perhaps even question the justification for some of the things surgeons do.

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Aims and ethics in surgery

The words of Martial which adorn the crest of the Glasgow College will serve as a text for this brief dissertation on the purpose which should guide a surgeon's work. 'Non vivere sed valere vita'. Life does not consist only in living but in the enjoyment of health. As surgeons we must not be content merely to preserve life but to apply our skill in restoring our patients as far as is humanly possible to healthy contentment.

This aim, of course, has long been recognized by all branches of our profession. We have progressed far since surgeons were concerned only with curing fatal diseases and treating mortal wounds. The greater part of the work of many surgeons is concerned nowadays with relieving minor inconveniences and with restoring functional activity. This progress has been made possible by the increasing safety of surgical treatment. Fifty years ago a surgeon was glad to see his patient leave the operation room alive. Now he expects to see him leave hospital half restored to health and when this stage has been reached he will direct and supervise all the ancillary measures needed to complete the convalescence.

But there is still room for further advance. Despite the care given to rehabilitation there is still a wide gap between the return home and the restoration to physical and mental fitness. We know a great deal about the catabolic phase of the first few days after operation and a little about the anabolic phase of the next week or two. But everyone who has undergone a major operation knows that this is succeeded by a perfectly diabolic phase in which he seems to be making no progress at

all, and that two or three months may elapse before the tiredness and apathy wear off and full intellectual vigour is restored.

Delay in the return to full physical normality is seen in its most marked form in the aftermath to industrial injuries. Despite the attention to follow-up services it is still not fully realized how wide a gap there can be between the initial treatment and the return to full work, a gap which is often to be measured in months or years rather than shorter periods. Moreover there is a risk of overlooking the fact that the duration of disablement is not always related to the severity of the original injury, and in consequence there is a danger that while major lesions are treated from the beginning with the full resources of the hospital service, the lesions which at first sight appear to be minor may receive scant attention. As an example, a patient with a comminuted fracture of the femur will be admitted as an emergency and receive treatment at the hands of a full team of experts, and perhaps be sufficiently restored to fitness to return to work within a year. But a patient with a torn ligament at the ankle will be seen in the ambulance room or perhaps referred to his family doctor for simple measures of treatment, and may continue with minor yet disabling symptoms for considerably longer.

OFFICIOUS STRIVING

The attention given to promoting health rather than merely maintaining existence must raise a further question in our minds. Martial's apophthegm can be given another meaning, different from the generally accepted one which I have quoted. Here is the alternative version; 'Life is not worth supporting unless there is health'. There are some who believe that surgeons nowadays go too far in striving officiously to keep alive. We have to ask ourselves whether through pride in technical

achievement or perhaps a mistaken sense of values we pay too much attention to maintaining existence and too little to the quality of the life we preserve.

It has not always been so. The dilemma is imposed by no sempiternal religious or philosophical doctrine but by modern conventions. Here is what William Hunter wrote, exemplifying the general attitude of two hundred years ago. In a paper on obstetric treatment he began with a plea that the determination to perform a surgical operation

> should not be founded on the bare calculation of the chances for life but also upon the value of the life under consideration and of the suffering to be borne if the patient should undergo the operation and survive. Thus in old age the value of it is less in proportion; and it is less also in proportion as it is entailed with pains or infirmities or whatever will diminish or destroy the enjoyment of life. Existence is so nearly equal to nothing that its real value must arise from its connection with enjoyment; and where there is not, upon the whole, enjoyment, life is either worth nothing or a positive evil.

The ethical dilemma of 'officious striving' comes not infrequently in hospital work. There is the dilemma posed by the infant born with a brain defect which is manifestly beyond cure. Is it to be left to its fate, an early and often unregretted end, or is it to be condemned to an existence which is a travesty of human sapient life, a drain on the affections of its parents and perhaps an economic disservice to its healthy siblings? And at the other end of the journey there is the dilemma posed by the cancer patient, or the aged victim of any other incurable and progressive malady, near the end and oblivious to everything but pain, who by well-meaning but possibly misguided care is denied relief to his sufferings and even brought back from the brink of death for a few more distressing weeks of twilight existence. The humane surgeon, watching his patient suffer, realizing the inevitability of his

fate and thoughtful of the distress to those the patient is leaving behind, may be tempted to let the natural process of decay proceed to its appointed end and even to hasten it. He who believes that by divine decree the ultimate spark of life must be preserved will take the opposite view.

An even more pressing problem is presented by the patient whose brain is so damaged, by a head injury or a period of anoxia due to temporary cardiac arrest, as to cause quadriplegia and respiratory failure. He remains deeply unconscious, perhaps for many months. During all this time aeration can be maintained by an artificial respirator but if the motor is switched off the heart will cease beating in a few minutes. Is this a human life to be preserved at all costs, or a pithed heart-lung preparation whose vital span has already been exceeded? These are ethical questions no man can solve. All we can do is to pose them and leave the decision to the individual conscience.

SOME SURGICAL FASHIONS

Apart from such life-and-death matters of conscience, and apart from the general ethical doctor/patient relationships which are well understood by all, these are considerations of particular importance to surgeons who may be tempted, often without realizing it, to give the atractions of technical achievement too high a place in their thoughts.

The most famous example of pride in surgical expertise promoted to a place surpassing honest judgment is the surgical fashion lampooned by George Bernard Shaw in his play *The Doctor's Dilemma*. Shaw was not free from bias against the medical profession, but his biting ironies however misdirected on other occasions did in this instance have a worthy target. He mocked the surgical fashion of his day, and particularly the crime of those who performed unnecessary exenterations for

imaginary disease. The muciform sac was his symbol for the fashionable disturbances found in ladies of fashion in those far-away Edwardian days, the colitis and visceroptosis for which the famous surgeons of that era plicated the caecum or suspended the stomach or removed the whole colon on the supposition that thereby they would eliminate some potent source of focal sepsis. Later there was the cult of ureteral stricture, not the genuine stricture which undoubtedly can occur, but the bogus stricture which the fashionable urologist of those days could be certain of finding in leisured ladies with vague abdominal complaints and a willingness to undergo repeated and rather intriguing and certainly expensive forms of instrumental treatment.

Now the fashionable ladies have gone and in some mysterious way their diseases have also disappeared, but surgical fashions of less suspect origins still come and go.

There is, however, this difference. Shaw's diatribes were not published every day. Now the press and radio are up to the minute, and while publicity may do good in the long run, its first effect is to encourage the cranks and excite them to further excesses. Admittedly the ephemeral interest of pressmen in test-tube babies, their zeal for wholesale abortions coupled with a horrified condemnation of the scientific use of the waste products of abortions, their ignorant presentation of the new-fangled, coupled with their suspicion of orthodox research, and their customary disregard for genuine endeavour, are the price we have to pay for trying to put our profession in the limelight. Sometimes the price is a heavy one, as we have seen recently in the field of heart transplants, a folly largely press-provoked. Fortunately its term was brief. As a unique method of killing two patients at the same time it did not last long; now its protagonists are in two senses disheartened.

All this is not to suggest that fashions, in the sense of

alternations of surgical practices, are all to be discouraged. They may simply represent the changing reactions to the best evidence available at the time. There is the example of thyroid disease, which in my own lifetime has been through five phases; surgery in the days when Crile popularized the procedure known as 'stealing the thyroid', drugs after thio-uracil had been introduced, surgery again when the long-term dangers from the anti-thyroid drugs became apparent, radiotherapy when iodine isotopes became available, now again back to surgery.

Nor is it to be suggested that every new fashion should be condemned out of hand, even though it seems to flout all scientific precepts. A decade ago every surgeon with a conventional scientific background was convinced that kidney grafting was doomed to failure, but a few enthusiasts persisted and now they stand completely vindicated.

Whatever the future has in store, it seems likely that surgical practice will be less liable than heretofore to the vagaries of fashion. The days of the pioneer prospector who could invent a new operation and turn it to his own profit are long past. Now any new practice, however respectable in origin, must face a barrage of criticism in the surgical press and at surgical meetings. Indeed there are some who fear that the forces of scientific scepticism may stifle progress in a craft which has always relied heavily on individual initiative. But there is no doubt that emphasis on the critical evaluation of results and on the use of therapeutic trials will provide safeguards against rash experimentation.

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The changing face of surgery

In 1884 William Macewen addressed the International Congress of Medicine in Copenhagen. His subject was the operation of osteotomy for ricketty deformities at the knee. He gave an account of the operation he had perfected and reported a personal experience of over 800 cases.

That operation is now a thing of the past. Rickets, surgically speaking, ceased to exist about 1920, when Vitamin D became available for our sun-deprived, food-deficient children. Few surgeons now actively engaged in the practice of surgery have ever seen Macewen's osteotomy performed. By contrast, many surgeons at the present time spend their days treating diseases which Macewen in 1884 would hardly know. So the surgical panorama unfolds, on the one hand advances in surgical technique, on the other a shifting incidence of disease.

Other changes in the face of surgery have taken place since those days. Some old diseases have diminished in incidence while others have taken their place. Appendicitis in 1884 was thought to be a new disease and was certainly not often diagnosed; it grew to be the commonest of surgical emergencies. Perforated peptic ulcer was certainly a rarity in 1884; it increased in frequency to a high peak about 1950 and since then, in Britain, it seems to have been becoming less common. Lung cancer was certainly rare until the last forty years or so and has become increasingly frequent since then. The reason for its changing incidence is well known, but by contrast the remarkable drop in the frequency of gastric cancer in recent years (in the US but not in Britain) is quite unexplained.

But the most profound change in the face of surgery has come as the direct result of the introduction of antibiotics. A surgical textbook of thirty years ago would give half its chapters to diseases caused by bacteria. Now nearly all of them can be prevented or cured. Gross staphylococcal infections like osteomyelitis with its high toll of death in young children and its long story of sequestra and suppuration in those who survived. Streptococcal wound infection, spreading, toxic, and highly lethal. Tuberculosis, with its record of swollen glands, persistent sinuses, spinal curvatures, cold abscesses, debility, wasting, and death. Gonococcal pyosalpinx, and in men the callous urethal stricture with its inevitable complication of ascending urinary infection. Syphilis, with its gummatous swellings in every organ of the body and its terrible legacy to the second and third generation. All these have disappeared with hardly a trace.

CHANGING TECHNIQUES

During this time also there have been some notable changes in surgical techniques, and a gradual shift of emphasis from surgery as a feat of individual expertise to the conjoint effort of a team.

Hippocrates, over two thousand years ago, had defined the attainments to be required of the operating surgeon.

> The finger nails neither to exceed nor to come short of the finger tips. Good formation of the fingers, thumb well opposed to forefinger. Practice at all operations with each hand and with both together. Arrange the boiled water, the light, the instruments, the position of the assistants. Promote ability, speed, painlessness, elegance, and readiness.

Until our own time, dexterity has remained the hallmark of the surgeon, and some have cultivated ambidexterity; regretfully there have been a few whom jealous rivals have described

as ambisinistrous. But in recent years the most dexterous have required to an increasing extent the services of an enlarging team, and a much more complicated mass of equipment.

When I was very young I assisted a fashionable surgeon in his private practice. In the nursing home where he worked a room would be set aside as the operation theatre, with a portable table, a sink, and a few basins. All the tools and the sterile equipment would be taken there in two Gladstone bags. The patient, anaesthetized in one of the bedrooms, would be carried downstairs on a canvas pallet. The stout old lady who owned the home would double the part of theatre sister. She handed the instruments, compensated for the deficiencies of her antiseptic technique by generous dollops of carbolic acid, doled out her tenuous stock of home-prepared catgut and horse hair, and saved any left over for the next case the following week. I hasten to add that even at that time conditions such as I have described were out of date, though by no means exceptional. I need hardly say that things have changed a good deal since then.

The extent of the technical advance in the conduct of surgical operations can be illustrated by comparing any operation theatre in any of our major hospitals of thirty or forty years ago with a modern unit of cardiopulmonary or neurological surgery at the present time. In those earlier days, comparatively recent as they may seem, the theatre scene had changed but little since Lister's time. The operation team was grouped as for a drama, as indeed it was. There was the concentration of interest in a small cone of limelight. There was the individual feat of expertise in which the maestro brought his skill and dexterity to bear upon his protégé the patient. In the limelight, at the converging point of interest, was the surgeon, dominant and incisive; below him the patient, inert, unconscious, submissive; around them, the rest of the team like a Greek chorus focusing attention on the two principal participants.

Contrast the scene at the present day. The theatre is crowded with workers, each intent upon his particular duty. The anaesthetist, no longer much concerned with the simple task of keeping his patient asleep, supervises the respirators and infusion apparatus designed to control blood-gas concentrations, blood volumes, and acid-base level. Technologists, enmeshed in tubes and wires behind a formidable array of pumps and monitors, inspect remote meters which check the heart beat and the blood pressure. Behind and around them are all the engineering devices, the air purifiers and sterilizers, the suction pumps, and diathermies and all the rest of the scientific impedimenta essential to this surgical *tour de force*; and somewhere, almost lost in the crowd, the surgeon himself, the creator of this little world of science but now just one of the many actors on the stage.

But though encompassed by science the surgeon himself still employs the methods of former days, for the living tissues cannot be fused or welded. Surgery still consists of cutting, coagulating, and cobbling. We make the incision, arrest the bleeding, put in the stitches. Our instruments change but little. It is true that Lister's probe and Macewen's osteotomy are out-of-date but the basic tools remain the same. Ambroise Paré abolished boiling oil but we still use the actual cautery. Catgut is out of favour but we still use needles and thread and we still need to distinguish a reef knot from a granny. Surgery is still in essence an art and a craft.

SURGERY'S DEBT TO THE ANCILLARY SERVICES

Much of this progress in surgical craftsmanship has been made possible only by reason of the contributions of the ancillary services. Of these, the most recent have been the contributions

of the physicists, who have provided a wide range of specialist advice and collaboration, particularly in relation to scientific monitoring, electronic devices, radio-isotope tracer techniques, and radio-therapy callibration; and the biological engineers, who have devised the heart pumps and respirators, the plastic valves and fabricated arteries, the artificial joints and every other form of prosthesis.

But there are three older ancillary services whose work is now so pervasive throughout the whole field of hospital care and so quietly efficient that they are accepted without acknowledgment and indeed taken for granted.

Only the senior members of our surgical craft can remember the anaesthetic deficiencies of earlier days and thus understand the immensity of our debt. It is now thirty years since anaesthetists forsook the ether bottle and the face mask and adopted in their place the modern battery of syringes, needles, and cannulas. The intravenous anaesthetic drugs and relaxants of the curare group made this advance possible. The increased safety, combined with the improved access to deeper structures which they made possible have enabled surgeons to work more deliberately, to explore more extensively, and to achieve their object more thoroughly and safely than ever before.

Coincident with this development in anaesthetics there has been a change in the outlook of anaesthetists. No longer content to be the handmaidens of surgery they have extended their influence to cover the whole care of the general state of the patients during and after operation, and to fit themselves for this duty they have become experts in a wide range of disciplines from respiratory physiology to the biochemistry of tissue fluids. There can be no doubt about the benefit which has accrued to patients.

During this period the laboratory service has adopted new methods and been more ready to place them at the service of

the surgical team. Flame photometry, chromatography, electrophoresis, and a score of other new methods have been introduced, and the automatic analysing machines have made it possible to carry out several hundreds of biochemical estimations during the course of treating a single patient.

But the story of the blood bank is even more exciting. I remember how nearly fifty years ago as houseman on a busy surgical ward I would set up a transfusion about once a month. It was a major enterprise. All the relatives were lined up for matching. A beaker, a glass funnel, some rubber tubing, and a few needles were boiled in the instrument sterilizer. The blood was drawn off into an open jar containing citrate solution, stirred gently with a glass rod, then poured (to remove clots!) through layers of gauze stretched over the open mouth of the funnel, and so directly into the patient's vein. One pint of blood was the standard amount, more than two almost unknown. Rhesus reactions and pyrogen effects were common, but generally mild. Bacterial contamination must have been frequent, but since the blood was administered at once it was of little consequence. Since the blood was not pooled the risk of hepatitis was negligible.

I recall that about 1935 a local dentist formed a panel of voluntary donors, and himself gave over a hundred pints. From time to time I managed to call upon the services of two or three members of his team where one would have sufficed and so by subterfuge started a little blood bank of my own. This was against the accepted policy, for it was thought that donors would only be willing to contribute blood to patients who could be individually named and identified. Now many blood banks handle more than a hundred thousand units a year. We accept this humane offering with little thought, even on occasion demand it as a right. We should count our blessings.

THE OUTLOOK IN SURGERY

For the future, while we may hope, without great conviction, that more of the diseases we now treat surgically will disappear or be cured by other means, we can be sure that in other directions the field of surgery will continue to enlarge. We may be sure that surgery will find an increasing sphere of usefulness in our ageing population, in the degenerative vascular lesions of the aged, in osteoporosis and its complications, in the paralyses and debilities which make old people bedridden, in Parkinson's disease, in hemiplegic deformities, in incontinence of urine, and all the rest.

We may be sure that in our affluent society surgeons will turn their attention more and more to the problems of coronary disease and atheroma and obesity. We may be sure that in this restless age the stress diseases will come increasingly to the fore. We may be sure that with increasing awareness of social and economic issues surgeons will pay increasing thought to the rheumatic disorders and other chronic diseases which impair working capacity. But most certain of all these forecasts, we may be sure that in this age of high speed travel the scope for accident surgery will not diminish.

But when we essay the task of prognostication in detail, we must remember the pitfalls into which many of the surgical prophets of the past have stumbled. It might be claimed that almost every surgical advance in the past century or so has been made in the face of dire warnings by disillusioned senior surgeons that no further advance was possible. An Amsterdam surgeon is credited with having claimed in 1840 that the surgical art was then within measurable distance of perfection, and there must be many of the same mind at the present time. For one who, like myself, has seen so many, so unexpected, and so well nigh miraculous advances take place, prognostication

would be particularly foolhardy. All I can do is to indicate the fields in which progress is most evident at the present day, and to point out the untilled ground which should invite attention tomorrow. In the following paragraphs I shall endeavour, for the information of those readers whose normal interests lie in other directions, to sketch the main scenes of activity in different fields at the present time. Necessarily it will only be possible, within the limits of the space available, to review the situation in a most general way, and at the risk of giving summary judgment of a superficial kind on matters of deep import which continue to deserve profound study.

ABDOMINAL SURGERY

Peptic ulcer

Abdominal surgeons continue to debate the surgical treatment of peptic ulcer, as they have been doing since 1880. In those days and for many years thereafter every ulcer patient coming to operation had pyloric stenosis. Nothing less fearful would have justified such a perilous step. Then the operation of gastro-jejunostomy was introduced and it quickly became the operation of choice. The results were admirable. Probably no other operation in the whole history of surgery conferred so much benefit on so many. For forty years in the hands of those early pioneers it held pride of place.

In those days surgeons judged by immediate results. What else mattered? Then patients began to return with fresh symptoms due to a new ulcer at the anastomosis and it began to be realized that the short-circuit operation, valuable as it was for relieving the obstruction, failed to neutralize the acid and merely diverted it to play upon a different and more susceptible site.

At this stage following the lead of Germanic schools of

thought, surgeons in this country began to turn their attention to the operation of gastrectomy. It was heralded, despite all physiological precepts, as designed to remove the acid-secreting part of the stomach, but its main attraction for many surgeons lay in the technical challenge offered by what, in those days of open ether anaesthesia, was a quite major and often dangerous operation. Moreover, it created its own aftermath of post-gastrectomy disorders, protean in character and including immediate complications such as twists and obstructions and blind loops, the early postprandial dumping syndrome, the late postprandial hypoglycaemic syndrome, the decalcification syndrome, and various deficiency states due to impaired absorption of proteins, fats, and vitamins.

While as a result of increasing experience the early dangers and late disabilities of gastrectomy have been reduced in incidence and severity, they were still sufficiently daunting to induce the majority of surgeons in this country to look with favour upon vagotomy when it was introduced some twenty five years ago.

The operation of vagotomy is almost always combined with a drainage procedure such as gastro-jejunostomy or pyloroplasty, on the supposition that denervation of the stomach would otherwise lead to a functional delay at the pylorus with stagnation of the gastric contents. Since two separate factors are introduced, a nerve resection which affects both the secretory activity and the motility of the stomach, and an anastomosis which short-circuits the ulcer-bearing duodenum, there is always an element of doubt as to which factor should bear the main credit or responsibility for any effects upon the clinical progress. Popular belief gives major credit to the vagotomy for the relief of pain and the healing of the ulcer which usually result, despite the fact that old experience showed the drainage procedure to be quite capable, in a large proportion of

cases, of achieving the same result without any denervation. Incidentally, popular belief also attributes to the vagotomy a fairly common sequel, namely post-operative diarrhoea, although old experience showed that it too might result from the drainage procedure alone.

Vagotomy signalized a change of surgical thought, from the anatomical approach of large-scale resections to the physiological approach of attacking the acid mechanism. It was introduced by a surgeon who was himself a physiologist and was a direct heritage from the physiological laboratory. Its success provoked a new and continuing interest in the normal mechanism of the gastric secretion and the factors controlling it. Since then every department of surgery has installed its gastric laboratory, and surgeons all over the world have studied the functional effects of the operations they undertake. Indeed, critics have suggested that some of them have become more interested in the effects of operation on the gastric functions than on the ulcer itself.

The clinical and experimental researches on the stomach which have come from surgical laboratories all over the world during recent decades would be sufficient by themselves to fill many monographs. In brief it may be said that they fall into two categories. In the first place there are the researches in the tradition of Pavlov and other early physiologists, mainly on dogs with isolated gastric pouches but latterly also upon the human subject, designed to determine the physiological mechanism of the process of gastric secretion and the biochemistry of the hormones concerned in that process. In the second place there are the clinical researches designed to improve the treatment of peptic ulcer in man. In this second category a welcome feature has been the increased use of accurate follow-up records and therapeutic trials, to which further reference will be made on a later page.

A less welcome feature has been the tendency for surgeons, continually on the search for innovations, to devise new operations or new combinations of old operations and to apply them to their patients without critical assessment. Thus the original vagotomy in which complete division of both vagus nerves was postulated has been varied and modified in the direction of different forms of partial vagotomy and each of the variants has been recommended for use in combination with gastro-jejunostomy, with gastro-duodenostomy, with pyloroplasty, with resection of the gastric antrum, and with various kinds of gastrectomy. It used to be said that in a conference of twenty abdominal surgeons there would be twenty operations of choice for peptic ulcer; now the figure might be put at nearer fifty. Fortunately the fundamental needs remain unchanged, to remove or by-pass the ulcer and to prevent recurrence by reducing the gastric acidity. Since all the methods mentioned above achieve these objects there is little difference in the end-results so the diversification brings no disadvantage to the patient.

Crohn's disease and ulcerative colitis

Second to peptic ulcer, interest in the field of gastro-enterology has centred upon the related conditions of Crohn's disease and ulcerative colitis. The nature of these two diseases remains obscure, and the classical description of them as two distinct lesions—the one belonging to the terminal ileum and the other to the large intestine—is clouded by many exceptions. In Crohn's disease the main problem of surgical treatment is concerned with those cases with multiple, active, widely dispersed lesions in which a limited resection will invite further trouble from recurrence, while a complete resection will dangerously impair intestinal absorption. In ulcerative colitis the improvement in general health following total colectomy is sufficient justification for this radical procedure, but despite improve-

ments in surgical technique and in nursing care an ileostomy leaking continuously at the surface still presents a major inconvenience. In both conditions there is room for further technical advances, and still greater need for better understanding of the nature of the disease processes.

Liver, gall-bladder, and pancreas

The liver continues to offer little scope for surgical expertise. With rare exceptions diseases of the liver affect all parts of the organ, so partial hepatectomy is indicated only in exceptional instances. Complete hepatectomy with replacement by a cadaver homograft has become a theoretical possibility in recent years, but much more remains to be achieved before it can be translated into a practical proposition. Liver transplantation presents problems much greater than those which concern kidney grafts. There is not and never can be anything corresponding to the dialysis machine for tiding the patient over the acute phase, while the technical difficulties of the operation are much greater and the immunological problem is no less. Consequently at the present time there is no indication that progress is likely to be made in the near future.

In the one hepatic disease for which surgical treatment is sometimes needed, in bleeding from oesophageal veins distended as a result of portal venous obstruction, it is significant that the surgical treatment is designed simply to deal with a dangerous secondary result of the liver lesion and that the operation, a porta-caval anastomosis, gives no benefit to the primary disease and may do positive harm. In this field surgery can at best be palliative.

By contrast, the gall-bladder for nearly a hundred years has offered a profitable quarry for surgical excavation. The treatment of calculous cholecystitis has long been standardized and at the present time interest is mainly focused upon the surgery

of the common bile duct, upon the technical problem of reconstructing it after injury, the methods of dealing with multiple stones and muddy deposits, the steps to be taken to avoid recurrence, and the doubtful advantages and undoubted dangers of interfering with the sphincter mechanism.

The pancreas, deeply placed within the retroperitoneal space, retains its old obscurity. Except in acute pancreatitis the biochemical tests of pancreatic function have proved of little help in diagnosis, and so far the results of isotope scanning have proved disappointing. The surgical treatment of chronic pancreatitis continues to be unsatisfactory, and interest centres principally round the aetiology of the disease, rare as it is in Britain and then generally related to gallstones, yet common in America and there nearly always related to alcoholism.

Even more unsatisfactory is the surgical treatment for cancer of the pancreas, which develops insiduously and is rarely diagnosed or even suspected at a stage at which operative treatment is possible. It is difficult to imagine the possibility of any improvement in this situation except as a result of some quite unforeseen progress in the general diagnosis of malignant disease.

CARDIOVASCULAR SURGERY

During the lifetime of most present-day surgeons undoubtedly the field of most spectacular advancement has been in the surgery of the heart and great vessels. It started in the late 1940s with the pioneering work of Fallot's tetralogy by Blalock and Taussig in Baltimore, and, soon after that, the treatment of mitral stenosis initiated by Brock and his colleagues in London. Later the invention of the artificial heart pump and respirator made it possible for surgeons in many countries to devise radical reconstructions for other congenital defects, and radical replace-

ments for other valvular lesions. Even that most lethal of valvular diseases, aortic regurgitation, can now be treated by valve replacement with a prospect of lengthy survival in over 80 per cent of cases.

Looking back, it is a continual source of wonder for older surgeons such as myself that so much has been achieved in a field which, a bare thirty years ago, was completely untrodden, and indeed was forbidden territory. Thirty years ago merely to expose the pericardium required some courage. To enter a heart cavity and repair a defect or replace a valve would have been deemed madness. The co-operation of cardiological physicians, radiologists, anaesthetists, and biological engineers made these things practicable, and indeed a matter of routine.

It is not surprising that after such rapid advances cardiovascular surgery now seems to have entered a phase of consolidation. At the present time the problem receiving greatest consideration is the type of prosthesis to be used for replacing a diseased valve. It must have a rigid ring which can be stitched in place, and a mobile ball or flap able to transmit a large volume of blood in a smooth flow with the minimum of eddying and yet able to close securely during diastole; it must be free from the physical and electrical properties which lead to clotting, it must provoke no adverse tissue reaction, and it must be able to withstand the to-and-fro movement and friction damage of seventy or eighty movements a minute for many years. Up to now a ball-and-socket type of valve has enjoyed favour but cadaver homografts and autograft valves fashioned on the spot from the patient's own fascia lata are also in use. At the present time the indications are that they will be replaced by a plastic prosthesis made of a delicate tilting disc which floats freely in relation to a plastic ring.

In the wider field of vascular surgery there have been two major fields of development in recent years. In the larger

vessels of the thorax and abdomen the extended use of bypass techniques has made it possible to operate with comparative safety upon the aorta and its major branches for all sorts of aneurysm, for obliterative diseases, and even for acute rupture sustained as the result of accident. In the smaller vessels of the extremities the treatment of arterial obliteration, formerly dependent upon the uncertain benefits of sympathectomy, has been powerfully advanced by such operations as endarterectomy, prosthetic implants, and venous transplants.

Two other small but important developments in vascular surgery deserve mention. The first is an increasing awareness, thanks to improvements in radiological techniques, of the importance of obliterative lesions of the coeliac and mesenteric arteries as a cause of obscure abdominal symptoms. The second is an increasing though rather critical interest in lesions of the renal artery as a cause of unilateral renal hypertension which is occasionally amenable to vascular surgery.

Before we leave the field of cardio-vascular diseases mention should be made of two procedures in which the surgeon plays a minor role and the chief credit must go to the cardiologists and electronic engineers. They are of especial interest because they use modern methods of electronics to restore physiological reflexes which have been upset by disease. The first of these is the pacemaker which uses an artificial current derived from an implanted battery (or more recently from a source of atomic energy) to provide a regular cardiac impulse where the normal impulses are blocked by disease. The second one, still in the experimental stage, is designed for the treatment of hypertension by amplifying the carotid sinus reflex which normally takes part in the mechanism for stabilizing the blood pressure. The surgeon's part is to implant an electrode alongside the nerve to the carotid sinus, with a wire leading to a subcutan-

eous terminal in front of the sternum. A radio transmitter carried in front of the chest can then be used to stimulate the nerve and sensitize the reflex mechanism so that a graded degree of generalized arteriolar dilatation results and the raised blood pressure is thereby reduced.

CANCER SURGERY

The treatment of cancer by operation continues to engage the attention of many surgeons, but with little reward. It is indeed becoming apparent that in cancer surgery the results obtained depend upon the biological character of the particular kind of growth and the anatomical character of the particular site than upon surgical expertise, important though it is. Thus, skin cancer (excluding melanoma) is almost always of relatively benign character, and the results of treatment whether by surgery or radio-therapy are correspondingly good, whereas in cancer of the lung or cancer of the pancreas or cancer of the stomach the biological character is such that in a large proportion of cases no treatment can be of any avail. Similarly, in respect of anatomical circumstances a cancer of the oesophagus though slow to develop and relatively late to metastasize yields few surgical successes, whereas cancer of the colon, which can be removed with much of its lymph drainage, is often curable. Even within a single organ the biological character of the tumour profoundly affects the outcome. For example, in the mammary gland the medullary cancer though highly malignant as judged by its histological character carries a remarkably good prognosis, perhaps due to an immunological type of host resistance.

In an effort to improve the results, surgeons have sought a way out in two directions. On the one hand there are those

who favour an increasingly vigorous surgical attack with ever more radical resections of the primary growth and its related lymphatic nodes and even a readiness to tackle metastases in the liver and lungs provided that they are not too numerous. On the other hand there are those who have sought increasing help from radio-therapy, from cytotoxic drugs and, in the case of breast cancer, from endocrine treatment.

Of radio-therapy it may be said that the indications are becoming more clearly defined but also progressively narrower. The types of growth which are most responsive to radio-therapy are precisely those lesions of the integuments and related tissues which respond most satisfactorily to surgery; the types which are most difficult to cure by operation, including lung cancer and nearly all tumours of the alimentary and urinary tracts, are completely resistant to radio-therapy. Moreover, in the debatable zones between these two extremes, notably in breast cancer, the place of radio-therapy grows less and less.

Of the cytotoxic drugs it may be said that they were a straw to be clutched in desperation, and apart from one or two rare and rather anomalous types of growth they have failed to justify their continued usage. Of endocrine therapy for breast cancer also there is a sad story of disappointment. The euphoria among surgeons and patients alike engendered by the early reports of a few dramatic successes have been falsified in the event, so that the first wildly extravagant estimates of improvement in 50 per cent or more of cases have been whittled down to a mere 10 or 5 per cent or even lower. However, both of cytotoxic drugs and endocrine measures it may be said that they have provided justification for hope for the future, and given a stimulus to researches on other comparable therapeutic measures.

As regards details of operative treatment, breast cancer has

been a target for surgical endeavour since Halsted's day, but despite the efforts of surgeons in all parts of the world the results remain much the same as when Halsted introduced his radical mastectomy seventy years ago. Nearly all long-term surveys of unselected series of cases show the same sort of result, whatever the details of treatment, namely a ten-year cure rate of between 40 and 50 per cent. The reason is not far to seek. In more than half the cases dissemination beyond the confines of the mammary gland had already occurred before the treatment had been instituted. Thus the heated controversies between the advocates of different types of operation and different techniques of radio-therapy have little relevance.

Attention is therefore now being diverted back once more to the question of early diagnosis. It is paradoxical that for a cancer so superficially placed there should be such difficulty in bringing patients to operation while the growth is still in an operable stage. Since the growth rate of breast cancer in most cases is extremely slow we can assume that as a rule the primary nodule must have been present for many months before it has attracted attention. Unfortunately it is clear also that in many cases wide dissemination of malignant cells must take place while the primary nodule is still very small and easily overlooked. Consequently, there are many difficulties in the way of achieving improved results through earlier diagnosis. Survey of hospital case records show that the majority of patients claim to have consulted the family doctor within a week or two of first noticing the lump, and the delay before operation is undertaken rarely amounts to more than a few weeks. Any real improvement in early diagnosis must therefore depend upon wide measures of public education or upon massive screening programmes.

KIDNEY GRAFTING

It is fortunate that the first organ to be grafted was the kidney, for with a few isolated exceptions it is the only one to have proved successful. The fate of heart transplants has been too well reported in the popular press to require further comment; the prospects of liver transplants are still meagre. By contrast, kidney grafting is now in regular use, and since improvements in operation technique and post-operative care have been paralleled by advances in immunology the further outlook is increasingly hopeful.

It is interesting to look back, to see why, despite the gloomy prognostications of many sane observers, this successful outcome has been achieved. The first kidney transplants were between identical twins, so there was no immunological problem and it was possible to focus attention upon questions related to the operation technique. Later, a kidney from a near relative was used, and although matching methods had not been perfected then it may be guessed that the immunological discrepancy would tend to be small; and since the donor was healthy and the transfer could be effected on the instant there were none of the problems relating to removing deteriorating kidneys from a cadaver. Finally, by the time cadaver grafts were coming into regular use the matching techniques had been elaborated, while the availability of dialysis machines made it possible for potential recipients to be brought to a state of readiness for such time as a suitable kidney became available, and later to tide the patient over the post-operative phase until the grafted kidney had recovered sufficiently to resume its functions.

At the present time the problems relating to the operation and the immediate post-operative course have been solved, and the steps needed in the continued care to avoid immunological

rejection are fully understood. The imposing problem in providing for the large number of kidney cripples who at present get no treatment arises from administrative and ethical difficulties.

The cadaver kidney must be obtained within fifteen minutes of the time of death. It must have come from a patient whose death had occurred abruptly, for a prolonged pre-agonal decline would mean a degenerating kidney. Facilities must be available for the kidney, after removal from the cadaver, to be perfused at once with ice-cold fluid and stored at refrigerator temperature, and even so the operation to transplant it must be carried out within 12 hours. And during this brief time it is necessary to conform to the requirements of the law, to assuage the sensibilities of the next of kin, to conduct the compatibility tests, to select a compatible recipient, and finally to prepare him for the operation.

At the present time only a small proportion of patients moribund from kidney failure can be submitted to kidney grafting. The alternative is intermittent dialysis, but this also is only available to the few, it entails lasting constraint and is not free from risk. Even from the point of view of cost, measured in terms of medical manpower and nursing personnel as well as in money, the advantage lies with grafting.

It is clear that if this life-saving treatment is to be made available to all those in need an alteration of the law relating to the use of cadaver tissues is essential. Experience with cornea grafting shows that there is no popular aversion from the use of cadaver material and the sole cause of public anxiety is that the tissues should be removed only from those who are indubitably dead. This is a matter of special concern in the case of those victims of cerebral damage whose life depends from the tenuous thread of an artificial respirator. But until this problem is solved many patients dying of kidney disease will be denied effective treatment.

NEUROSURGERY

The brain and spinal cord are anatomically immured within their bony cage and physiologically insulated by the leptomeninges. Much of a neurosurgeon's work is also remote from the view of his colleagues in other surgical disciplines, so this brief view can only attempt to touch upon the more important of his activities. There are, however, two fields in which he works in close co-operation with orthopaedic and general surgeons, namely head injuries and lesions of the intervertebral discs.

In regard to head injuries, neurosurgeons are interested in the significance of cerebral concussion, in changes in cerebral blood flow and variations in the intraventricular pressure and similar physiological disturbances as well as the grosser manifestations of haemorrhage and compression of the brain. They are able therefore not only to provide the most effective treatment for the more serious cases of head injury but also to contribute to a greater understanding of the whole subject. This is particularly important because most head injuries must be treated in accident departments and only in the more severe cases is it practicable to arrange transfer to a neurological unit. Neurosurgeons have a duty therefore not only to make their services available but also to keep their accident service colleagues abreast with current opinion.

Intervertebral disc lesions also provide an important field for collaboration between neurosurgical and orthopaedic departments. At present the role of the neurosurgeon is limited to the care of that minority of cases in which there is evidence of root pressure. As will be mentioned on another page, there is a pressing need for continuing attention to this problem.

As regards brain surgery, the early work of Cushing and his followers on intracranial tumours has now given place as the

centre of interest to studies of such degenerative disorders as Parkinson's disease, and the treatment by heat coagulation or cold coagulation using the precise methods of pin-point localization made possible by stereotactic apparatus.

On the research side, neurosurgeons have always combined practical attention to methods of treatment with an interest in fundamental problems of neurophysiology ranging from the cerebral blood flow to the chemistry of nerve impulses. In the future such a liberal outlook may help towards the elucidation of other outstanding problems, such for example as the cerebral effects of internal carotid obliteration, the treatment of episodic headache or migraine, and even that most grievous of cerebral disorders, the state of epilepsy.

ORTHOPAEDIC SURGERY

Thirty years ago orthopaedic surgeons, formerly occupied mainly with children's deformities and skeletal tuberculosis, enlarged their sphere of activity to include fractures in patients of every age, and in the course of the next decade they assumed control of the whole accident service which was then in course of development. In consequence, many of their number have become fully involved in the ever-increasing responsibility for the victims of road accidents and other forms of trauma. In this field there have been notable improvements in organization and staffing, and a commendable amount of attention has been paid to the problem of providing a uniformly efficient accident service throughout the country. As regards the detailed methods of fracture treatment the most significant general trend has been towards the wider use of internal fixation by nails, screws, plates, and other prosthesis. To the historian it is a matter for sardonic comment that thirty years ago the most vociferous criticisms by orthopaedists of the fracture treatment

then undertaken by general surgeons arose from their use of these same methods.

Apart from trauma, the most notable advance in the field of orthopaedics has been in relation to diseases of the hip joint. Congenital dislocation of the hip had been an orthopaedic lodestone for many years, but more recently attention has shifted to the commoner and even more disabling disease of chronic osteo-arthritis. A fruitful association has developed with rheumatologists and biological engineers, and now much progress is being made, especially in the use of artificial prosthesis of metal or plastic materials to replace the diseased joint. A particularly intensive series of observations on this subject is mentioned on page 43. Success in this field has now stimulated others to experiment with similar methods for replacing the finger joints in rheumatoid arthritis.

It is a matter for regret that in other fields of orthopaedics the universal preoccupation with routine treatment of injuries has diverted interest from some related basic problems. There is, for example, the time factor in bone regeneration. We are told that in primitive tribes in tropical climes the unfortunate victim of a leg fracture would be buried up to the waist in caked mud for a couple of months. Now we bury him in plaster of Paris for the same length of time. There would seem to be scope for some fundamental enquiries into methods of hastening the process.

But on a more practical level undoubtedly the greatest problem in the field of orthopaedics is the condition commonly called the sore back, a term which covers spondylitis, lumbago, sciatica, osteo-arthritis of the spine, displaced intervertebral disc and doubtless other descriptions. This is a common affliction in men—it is comparatively rare in women—which presses most hardly from the economic point of view on manual workers in the heavy industries. It has been claimed that back

pain is responsible for eighteen million lost work days every year in Britain and a loss of £90 million in wages alone. The cost in productivity must run into many more millions.

The usual story is that the man has strained his back, either in the course of some major physical activity or by some quite insignificant twist. He goes off work, attends his doctor, is given physiotherapy, but the pain persists for a long time and later is very apt to recur after minor stresses. Whatever treatment is applied, there is liable to be a permanent disability. For a manual worker in the heavy industries it is an economic disaster.

At the present time few medical men take much interest in the problem. The routine load of large outpatient departments, the chronic resistant nature of the disease, and the built-in pessimism which is often displayed by the sufferers, militate against the creation of great enthusiasm. When there is evidence of nerve pressure from a displaced disc there is a clear indication for active treatment, but for the remainder there is only the despairing counsel of a strait jacket and a rigid bed. There is a clear case for a more vigorous search for more effective treatment.

PAEDIATRIC SURGERY

In this specialty in recent years the greatest attention has been directed towards the related problems of hydrocephalus and spina bifida.

In congenital hydrocephalus methods have been developed for draining the distended cerebral ventricles through valved tubes into the jugular vein or the vena cava or even as far as the peritoneal cavity, and in a proportion of cases such measures have given relief for periods to be measured in months or even years.

In spina bifida, where the lower part of the spinal meninges and even the greatly deformed spinal cord are exposed on the surface over the lumbar spine, the immediate danger is from bacterial infection, which gains access to the spinal theca and quickly proves fatal. This can be prevented if operation is performed within a few hours of birth. However, the operation does nothing to remedy the other secondary effects of the malformation, so that in many cases there remains a prospect of prolonged invalidism, repeated operative interventions, and permanent disablement from bladder disturbances and deformities of the limbs, and in addition there is a considerable risk that closure of the spinal defect by raising the pressure within the theca will lead to the development of hydrocephalus. The nature of the deformation is such that the prospects of improved treatment in the future seem remote.

POSTOPERATIVE COMPLICATIONS

Though the risks incident to a surgical operation have been reduced progressively and are now almost disregarded both by surgeons and patients, there nevertheless remain two hazards which call for attention, the one, wound infection, which is common but rarely severe, and the other, thrombo-embolism, which in its more severe forms is rare but potentially fatal.

Wound infection

Wound infection is an old but persisting problem. In 1884 William Macewen was able to report that in osteotomy for knock-knee by working under Lister's carbolic spray and giving strict attention to Lister's antiseptic ritual, he had reduced the incidence of wound infection to less than one per cent. Now, nearly ninety years later, no surgeon would dare to court disbelief among his colleagues by claiming such success. It is of

course true that severe wound infections of olden days have long since been eliminated and such infection as occurs now has little more than nuisance value in ordinary circumstances. Perhaps that is why we tolerate it so unconcernedly. But even though mild it adds its quota of discomfort and temporary morbidity and it leads to an ugly scar, while in an abdominal wound it may lead to herniation or even disruption; and when a prosthesis is being introduced, for example a new heart valve or a new hip joint, it may make all the difference between achievement and disaster.

This persistent vexation of wound infection is one of the unadvertised consequences of antibiotics. Part of Lister's success came from the fact that his carbolic acid supplementing Florence Nightingale's soap and water, cleared the hospital wards of dangerous sources of sepsis. Penicillin, by contrast, has had the effect of making every blanket a hotbed for resistant staphylococci. Before Lister's time Simpson of chloroform fame had seen that the only solution would be to evacuate the old hospitals and replace them. Now alas it looks as though our new hospitals with their closed ventilation systems will perpetuate the menace.

Not only bacteria but also viruses bring their dangers on to the hospital scene. In former days the slipshod methods of syringe sterilization which every practitioner employed may well have caused an occasional example of syringe-transmitted jaundice, but now in our dialysis units with their greater needs for blood and plasma all the sterilization techniques which can be devised seem unable to prevent much more serious outbreaks of that same disease.

These perils must not be exaggerated, and doubtless new methods will be found for warding them off. Nevertheless it remains a sad fact that even the best of our hospitals still present a small element of risk to those who enter.

Thrombo-embolism

Another problem of immediate concern to the operating surgeon, fortunately less common than wound infection but potentially more dangerous, is the problem of thrombo-embolism. Surgical operations are now so infinitely safer than even a generation ago, we are apt to forget that the safety is not absolute. For weeks and months the record remains unblemished, then an anaesthetic fatality, an unexpected cardiac arrest or a pulmonary embolism brings everyone aghast to realization of the tragedy. Of these calamities the most frightening, because it is so unpredictable and so utterly fortuitous is the pulmonary embolism. Of all the heart-burnings which every surgeon suffers the most distressing of all is the sudden collapse and death of a patient seemingly on his way to convalescence.

There is this vital process of blood coagulation, one of the most fundamental of all the phenomena of the defence mechanism in animal life. For seventy years or more, seventy times a minute, we rely upon the blood to course through our veins in its fluid state, but after a pin prick or a surgical incision we depend upon it to clot within seventy seconds. How to conserve the clotting process yet keep it under control still escapes us, yet surgery can never be made completely safe until this goal has been reached.

THORACIC SURGERY

With the diminshed incidence of pulmonary tuberculosis and bronchiectasis, the lung is now rarely removed except for cancer, and that infrequently. Instead, thoracic surgeons have turned their attention to the oesophagus and diaphragm, and particularly to the related conditions of diaphragmatic hernia and oesophageal ulcer. As a result there have been improve-

ments in operative technique so that repair of the hernia can now be carried out in many cases with a good deal of reliability and sometimes this procedure controls the reflux of acid juice and enables the ulcer to heal. There remains the problem of treating those cases in which the reflux continues to occur, and those in which persistence of the ulcer has led to the formation of a tight stricture.

Carcinoma of the oesophagus still poses a formidable challenge. Though slow in growth it is usually too far advanced when first seen to permit radial attack, and even in early cases it presents a technical problem of some severity, owing particularly to the tenuous friable character of the wall of the oesophagus, and its poor blood supply, which leads to a risk of leakage at the anastomosis. Even so, much progress has been made since the first successful resection was reported some forty years ago. In those days even to open the pleural cavity was not devoid of risk, and there were ingenious pull-through methods for extracting the oesophagus through the neck and replacing it by an artificial gullet fashioned in the subcutaneous tissues. Later it became usual to replace the lower part of the oesophagus by drawing the gastric fundus up through the diaphragm, but when this is done there is a risk that erosion by the gastric juice may lead to leakage at the suture line. An alternative method of replacing the oesophagus by an isolated segment of colon, swung upwards on a pedicle formed by the middle colic artery, or sometimes the left colic artery, is favoured by some surgeons, but at best the blood supply of the colon is not copious, and there is a risk that after dislocation into the thorax it may prove insufficient, so that part of the mobilised colon may become devitalized and give way.

Consequently, the surgery of cancer of the oesophagus remains hazardous. By imposing rigid criteria for operation, which means excluding from possible benefit all but a small

proportion of patients, some surgeons are able to claim a fair proportion of successes at the risk of what they call an acceptable mortality. While one may shudder at the use of such an epithet it remains true that since radio-therapy can offer nothing better the risk may well be considered worth taking.

For the future, it is possible that the cause of cancer of the oesophagus may be identified—for its geographical incidence points clearly to some environmental factor—but improvements in surgical treatment can only come from earlier diagnosis.

4

The polity of hospital surgeons

While the basic requirements for a surgeon's work in hospital remain the same, the standards of accommodation and equipment and supporting staff have changed greatly, but even greater have been the change in surgical relationships and in the organization of surgical services which are now necessary.

The early hospitals were charitable foundations for the indigent sick, 'voluntary' hospitals which relied upon charitable donations and gratuitous service. They had some pride in their history and enjoyed a position of privilege and esteem within the community but with their straitened resources they could do little more than provide exiguous accommodation for those patients who were acutely ill and those who were likely to benefit from short periods of treatment. For medical care they depended upon the unpaid services of medical men who in turn depended for their livelihood upon the fruits of private practice. Later there arose the municipal hospitals, with greater resources but carrying in those far-off days the stigma of the Poor Law and the millstone of the chronic sick.

The existence of those two competing and sometimes hostile types of establishment, the lack of co-ordination between the two and between individual members of each, and the wide gaps which neither group could adequately fill led in 1942 to the foundation of the Nuffield Provincial Hospitals Trust, with the primary purpose of encouraging the regionalization of hospitals. Their first action was to assess the existing situation by means of a series of notable hospital reports covering

different parts of the country. The stark facts provided by these reports, backed by other influential evidence presented by the Trust, played a valuable part in marshalling public opinion and moulding government policy towards the hospital scheme which was eventually adopted and incorporated in the act of 1947.

Until that time, accommodation for surgical patients had been dispersed haphazard in hospitals of different standards, ranging from the major teaching hospitals and the old established but often out-dated infirmaries in the larger towns to cottage hospitals in more remote areas. In more recent years improvement in transport facilities throughout the country has made it possible to concentrate nearly all surgical work into large hospitals related to the main areas of population, and finally to an increasing extent in the new district hospitals which are being erected in those populous areas which previously were ill-supplied. During this time the pioneer work of the Nuffield Trust in the planning and internal design of hospitals has led to some notable improvements in construction. While there have been lamentable delays in building, and while many out-dated hospitals have still to be replaced, it can be said that the over-all picture is at last beginning to improve, so there seems a good prospect that in another decade or so the surgical services throughout the country will at last be suitable housed.

So much, then, for the physical accommodation. But what can be said about the deployment of the surgical staffs, as between different hospitals in an area and within individual hospitals? To study this question intelligently it will be necessary first to consider the developments in surgical practice during recent decades.

SPECIALIZATION IN SURGERY

In recent decades the most notable development affecting the deployment of surgical staffs comes from the growth of specialization. Half a century ago there were specialists in diseases of the eye and diseases of the ear, nose, and throat but with these exceptions everyone who wielded a scalpel called himself a general surgeon and nearly every general surgeon considered himself fit to wield the scalpel for every kind of operation in every part of the body.

A few years ago I was invited to initiate a light-hearted debate on the 'Future of the General Surgeon'. I advanced the thesis that in Britain the general surgeon had no future, had indeed no present and had in fact long since ceased to exist. I recounted the long process of elimination in the course of which his stronghold over surgical practice had been undermined by the specialists, starting with ophthalmology and otolaryngology and extending to a dozen others, so that now his territory was almost limited to the confines of the abdomen. I prophesied that the process of erosion would continue and extend. I noted that specialties always start in a small way, then rapidly expand, and the smaller the start the greater the expansion. I invented the specialty of omphalology, which started with diseases of the umbilicus and soon enlarged to enfold every disability below the diaphragm. And I said that if I could have my life over again I would make a fresh start by setting myself up as a specialist on the sphincter of Oddi.

However, today we are not concerned with the future of the general surgeon but with the future of surgery in general, a very different matter. Yet the story of how specialization developed may help us to predict how the same process may continue in the future, and to decide whether any action is desirable either to expedite the process or to control it.

The surgical specialties began in different ways. Sometimes the break-through came from the invention of a new instrument such as the ophthalmoscope or the cystoscope. A pioneering surgeon having purchased the tool would exploit it to the full. As his fame spread so his practice would become narrower in scope but larger in numbers. So the specialty would be established. Sometimes the break-through came from a new technique, like Cushing's meticulous methods of craniotomy which Norman Dott brought back to this country fifty years ago; or like the complicated techniques which are now making kidney grafting a specialty of its own. Sometimes the process was determined by humanitarian considerations, like paediatrics which arose from children's charities. And in recent years the increasing complexity of surgery, which has made it necessary for every surgeon to know more and more about less and less, has continued the process. But in every case at the start there have been pioneering surgeons, discontented with the world, and their place in it, responding to the needs of the moment and determined to accept the challenge.

The story of the specialty of plastic surgery may be quoted as one of several possible examples to illustrate how the pioneering efforts of a few individualists can influence surgical progress. Plastic surgery is indeed the most ancient of all surgical specialties, for the Indian operation for restoring a nose destroyed by disease or cut off by a jealous spouse dates back to before the days of Buddha.

In our own era, especially in the days between the two wars, cosmetic surgery gained a new notoriety in the fashionable cult of face lifting to remove blemishes or conceal the ravages of age. Then came the Second World War, the plastic surgeons renounced the inconsequences of Mayfair and gave unsparing service to repair the shattered faces of young airmen, to cover old burns with new skin and to restore limbs crippled by war

wounds. The war ended, they turned to relieving the consequences of civilian trauma in the injured hand, to removing skin tumours and repairing cleft palates, and to all manner of operations requiring delicate handiwork.

Whether these incursions upon the traditional territory of other surgeons are to be described as pioneering or privateering —and both epithets have their adherents—there is no doubt that the development of this specialty has led to genuine contributions to the art and craft of surgery. The plastic surgeons have shown the need for delicate handicraft, dexterous manipulations, infinite care in stitchcraft. They have shown how to make neat incisions and obtain unobtrusive scars. Their zeal for these matters has led them to enquire into the process of wound healing, into the physical structure of the skin as an elastic covering, and into the factors which influence its tensile strength. And their interest in practical problems relating to skin homografts for burns and cartilage grafts for deformities has led them to undertake scientific researches of basic relevance to immunology. Thus individual enterprise and the will to succeed have led to immediate improvements in surgical practice and long-term benefits to medical science.

The value of an *ad hoc* specialist centre for the study of a particular clinical problem is illustrated by the specialist unit set up in Manchester for surgical replacement of the hip joint in chronic arthritis. It has been estimated that there are in Britain over 10,000 new patients each year who might benefit from this form of treatment, but few orthopaedic surgeons have the time or opportunity to handle more than a handful so the indications for surgery and the choice of operation remain undecided and every patient presents an individual challenge and an unknown risk. The Manchester unit comprises a small full-time staff engaged solely on this problem, treating a thousand cases a year with the skill and efficiency which comes from

intensive experience and now after ten years the fruits of their studies are available to the whole world. There is a need for more such narrowly specialist enterprises, designed for a particular purpose, maintained until the purpose has been achieved, and then terminated or modified to meet such new needs as the situation may determine.

While the advantages which can come from surgical specialization have to be acknowledged freely, we must also visualize the possibility that in the future it might lead to stagnation rather than continued progress. This is particularly feared when through force of circumstances the specialty has been immured in an isolated hospital, out of touch with other active branches of medicine in the main centres of teaching and research. The early pioneers did not suffer from their isolation for the initial stimulus kept them going but it might be difficut for those of their successors who lack their divine discontent to maintain the same impetus.

Isolation also spells disadvantages for the patients. Again we may take plastic surgery as an example, though almost any other specialty would do equally well. Plastic surgeons need to co-operate with others in their day-to-day work. For facial repairs they need the help of dentists. For skin tumours they must collaborate with radio-therapists. For hand surgery they must work in accident centres. To provide skin cover for wounds they must be available in the general wards and operation rooms. To treat patients injured by burning they must have immediate access to all the resources of departments of bacteriology and biochemistry. They cannot afford to work in isolation. Yet, alas, the present-day hospital building schemes in many regions have condemned them to do so.

Clearly the answer, for plastic surgeons and all other specialists, is to give them accommodation within the general hospitals, where there will be ready opportunities for consulta-

tion as well as all the facilities for helpful collaboration which are provided by day-to-day contacts with others of like interests.

TEAM-WORK IN HOSPITALS

Among specialists and among generalists there are wide differences in the arrangements for collaboration in surgical work within hospitals. At the one extreme is the state of affairs, more common in America than in this country, where individual members of the visiting staff, engaged mainly in private practice, attend their own patients dispersed in different parts of the hospital, and only communicate with other members of the staff to the minimum necessary for their patients' immediate treatment. At the other extreme there is the system which is most highly developed in the main teaching hospitals in London and in Scotland, in which there are within the one hospital multiple small functional units which are variously called charges, ward units, or firms, each forming a small self-contained family of doctors and nurses and patients.

Thus in such a hospital the surgical side would consist of up to half a dozen identical ward units, each comprising perhaps 40 or 50 beds, each with an operation room of its own, each with its staff complement consisting of a chief, one or two 'assistant surgeons' of consultant rank, a registrar and one or two housemen, each with a ward sister with her nurses, an orderly and (not least self-important) a ward maid. They formed a little world of their own within the hospital cosmos and in some cases had few dealings with the other planets in the same orbit.

The system had its advantages. The chief might play the part of a father of a family, watchful of the interests of staff and patients alike, transmitting the accumulated wisdom of his

years to the junior men, punctilious in his daily ward rounds, jealous of everything concerned with the good repute of his little empire. In good hands it was a system which evoked loyalty and maintained a tradition of responsible care. It was moreover a convenient system for day-to-day working, for it concentrated the activities of the senior staff within a circumscribed area. Patients liked it because it ensured personal care by a small group of doctors and nurses whom they got to know by name, and the continuity of attention gave them a feeling of homeliness.

But it was not always so utopian. It was a system resistant to change, perpetuating the outlook and methods of the oldest member. The 'assistant surgeons' who were in some cases already past their maturity, tended to divert their main interest to subsidiary hospitals where they could exercise more authority. The junior members chafed at the restraints and longed for a freer rein. The types of case admitted to the unit would mainly reflect the chief's own interests so the range for training purposes would become restricted. The seclusion and insulation from other units would discourage progress. From the point of view of the hospital service as a whole it was a system which by its rigidity would discourage specialization, so it tended to force many of the growth points of surgery away from the teaching hospitals which properly should have tried to retain them.

SURGICAL DIVISIONS

Modern trends in surgery have made inevitable a move away from these 'cottage hospitals joined by corridors' in favour of a system of providing common services suited to present-day requirements. Both systems have their advantages. The old system gave individual care on a very personal basis. It is im-

portant not to replace it *in toto* by a new system which while more efficient might also prove to be more heartless.

In recent years an attempt has been made to achieve this aim by co-operation within a divisional system. Thus the surgical division of a hospital would have a committee structure including all the consultants in general surgery and the surgical specialties and appropriate subcommittees for the junior members. Its duties would include the management of routine affairs such as duty rotas and holiday arrangements, and considerations of wider import relating to the hospital as a whole. The establishment of service departments transcending the scope of individual units would be an obvious field for divisional activities, as would be the training arrangements for junior members of the staff, the provision of ancillary services, the allocation of beds for particular purposes and similar matters. In this way the divisional structure could be expected to break down the barriers between separate ward units and to co-ordinate their activities without impairing their particular advantages.

Already in many major hospitals a start has been made by providing such common-service departments as the recovery rooms and intensive care units, and it cannot be doubted that more such schemes will follow as their need becomes apparent.

Intensive care units

The demand for intensive care units has been shown most clearly in relation to the growing toll of major trauma. When a major casualty is brought in from that modern battlefield the motor road, he suffers from the condition known as shock. Although the name is simple the condition itself is extremely complex, involving loss of blood and a complicated series of changes affecting the body fluids and electrolytes, the heart and circulation, the acid-base balance, the hormones, and the endocrine glands. Moreover, his injuries often are multiple and

multifarious and affecting different parts of the body. The internal combustion engine is no respecter of surgical specialisms. The patient may have a broken limb, a damaged brain, an injury to the chest. He needs the services of many experts, including anaesthetists, biochemists, specialists of different sorts, and of course experienced nurses.

There is the same need for intensive care for patients recovering after major operations, and patients with severe intra-abdominal diseases such as intestinal obstruction and peritonitis. They need a special unit where they can be cared for by medical men and nurses well versed in the methods of treatment which are necessary, in a place adequately furnished with the instruments and monitoring equipment and laboratory facilities needed for quick and efficient service. Sometimes it is possible to link the intensive care unit with the recovery room. Sometimes it can be combined with a medical unit for coronary care or pulmonary care. Whatever the precise circumstances—and it is still uncertain which is the best—it is clear that the old sacrosanct territory of the individual ward unit has been breached.

Renal units

A further breach has come recently with the development of kidney grafting. We have had urologists for centuries—cutting for stone was a recognized specialty in the middle ages—and recently there have appeared nephrologists who are specialists in kidney diseases. But kidney grafting calls for more expertise than these experts can provide. It needs an immunologist to match the patient and the donor. It needs a dialysis team to keep the patient alive until a suitable kidney can be found, and perhaps for a few weeks thereafter until the newly transplanted kidney can resume its function. It needs surgeons trained in the technique of blood vessel anastomosis. And it

needs a physician who is also something of a psychiatrist and perhaps something of a priest, who can reassure the recipient and give comfort to the dependents of the donor.

The emergency service

Team work of a different order is urgently desirable for the care of all the various types of acute emergency diseases which at the present time are admitted to the ordinary general medical and surgical wards. We are all familiar with the rota system in which each of four or five units or firms take emergency duty in turn. Thus for twent-four hours every four or five days, in addition to the normal duties of ward work and outpatient sessions and operation lists, all members of the unit from the senior consultant to the junior houseman undertake the extraordinary service of coping for a day and a night with an unpredictable number of urgent cases. Or, to be more precise, during the daytime the whole team is involved. During the night only the junior and less experienced members are available, and they are then faced with the responsibility, fatigued and overstressed as they may be, of some of the worst problems in some of the weakest patients.

The rota system carries other disadvantages too. In anticipation of receiving day certain beds are kept vacant, so that patients awaiting admission for non-urgent diseases are kept waiting. These spare beds may prove insufficient for a heavy receiving day, or they may prove redundant and therefore wasted. And if, as is still the lamentable practice in some hospitals, the emergency patients are brought into the general wards, the regular patients suffer a disturbed night and perhaps some lack of proper attention. After a heavy receiving night it takes a few days for the ward to settle down to its normal routine.

The solution is evident. In the interests of efficiency and

convenience, not to mention cost-effectiveness, it is essential to isolate emergency work from elective surgery and to provide each with its proper staff. There should be a common area for emergency cases, distinct from the general wards and preferably related to the intensive care unit. In this special area the emergency cases should be under the care of a team with a primary responsibility, day by day throughout the week, for this task. Where the volume of work justifies it, as in the case of most large city hospitals, the staff should be divided into three teams on eight-hourly spells of duty. Only in this way can the treatment of surgical emergencies be properly ordered.

Five-day units

A further kind of common ground between the separate ward units may soon be dictated by the growing shortage of nurses and the increasing load of nursing work demanded by modern surgical care. A major economy in nurse staffing could be made by creating a five-day unit, serviced by part-time married nurses during the daytime and with only a skeleton staff at nights and week-ends. Such a unit could be used mainly for patients brought in for investigations which in any event are not normally done at week-ends. It might also be applied for minor surgical cases requiring minimal care for two or three days.

5

The education of surgeons

Fifty years ago a young doctor on the morrow of graduation would be ready to pack his instrument bag and set off for the north of England or South Wales, the East Indies or West Africa, and would take with him all the knowledge and technical skill needed for every form of medical treatment and most of the standard types of surgical operation. His education was suited to the needs of former times, when a doctor might spend a lifetime in isolated practice, but it had changed little with the passage of the years, so that even as recently as 1939 it was still the accepted custom for a student to receive long hours of instruction in the operation theatre and to practice major operations on the cadaver.

Since that time in every department of the healing art there has come an explosive expansion of knowledge, while simultaneously there has come an increasing and very proper demand by the community for higher standards of medical care. The undergraduate curriculum has been brought into line with many of these new demands but is still capable of a good deal of improvement, and still more so is there a need for increased attention to the way the requirements of the curriculum are applied by individual teachers.

While surgeons must be concerned mainly with the teaching of surgery they have a duty also as medical men and intelligent citizens to express their views and exert their influence upon medical education as a whole. There could be nothing more hazardous than to leave teaching in the hands of the teachers. Quis dociet ipsos doctores? So in this surgical mono-

graph it is a veritable duty to animadvert upon the whole medical curriculum.

The expansion of knowledge has not only widened our understanding of the processes of disease and its treatment, but also has brought into use innumerable new techniques, so that the load of medical education has increased enormously. Consider the immense extension of our knowledge in biochemistry, enzymology, molecular biology. Consider the advances in such clinical subjects as haematology, endocrinology, cardiology, immunology. Consider the new pharmacology and the vast flood of new drugs put on the market every year. Compare psychiatry now with what it was twenty years ago. Consider the cathode ray oscilloscope and the transistor and all the other apparatus of electric monitoring, and chromatography, electrophoresis, flame photometry, and isotope tracing which have made these advances possible, and consider the advances in the study of chromosomes, no longer limited to the fruit fly, and consider all the new insight into the relation of minute structure to function which has come from the introduction of the electron microscope. From these and other developments every department of medical science from anatomy to virology has found itself enriched by a vast new treasure-house of knowledge.

But this explosion of knowledge has been matched by no commensurate increase in the receptiveness of that very unscientific organ the human brain. It is true that the temporal cortex has the storage capacity of a giant computor, retaining records of even the most trivial impressions on its unconscious memory files, but its intake mechanism works slowly and clogs easily, so that even the most intelligent and eager student soon reaches the limit of his rate of assimilation.

In the past there was an easy remedy, to extend the curriculum, but this can be done no more. The undergraduate phase

of training is already far too long, having regard to the needs both of the student and the state. It is basically wrong for a man to remain *in statu pupillari* for years after he is old enough both to vote and to fight, and indeed more than a third of the way through his active life. It is expensive for the state to educate him at such cost for the limited service he will be able to give in return.

How then can we so arrange it that in addition to this vast accretion of general and scientific data we can give him the training in craftsmanship which is the essence of surgery? The only possible solution, as is now becoming widely recognized, is to spread the education more equally between the undergraduate and the postgraduate phases. The undergraduate training, should give the student a broad education in the scholarly as well as the scientific disciplines and a particular introduction to the scientific aspects of surgery, but, as regards practical craftsmanship, only the skill and experience he needs, to cope with the duties of a house officer. The remainder of his training for a surgical career can be gained during his subsequent years as a registrar.

THE UNDERGRADUATE PHASE

For the undergraduate course in general there is increasing realization of the need to prune the curriculum of all the weeds and garbage of bygone days, but perhaps there is not so clear a perception of the need for care as to what is planted in their place. We must not replace the multitudinous memorizations of anatomy by a proliferation of pure physics. We must not replace those tedious bedside reminiscences by still more tedious incursions into the higher mathematics. We must be selective and discriminating.

It seems to me that we must face the problem squarely; what

is to be the objective in medical education? Do we wish to create scientists, of whom some may thereafter learn how to care for the sick? Or is it our aim, as I prefer to think, to give our students a good over-all education to enable them to become doctors in the widest sense, a training which should include a firm basis of science but also other things such as practical skills, a knowledge of human behaviour, broad humanitarian attitudes and a scholarly approach to professional life.

Moreover, we must make science the handmaiden of medical education, not its master. Just as we use the new machinery of computors and transistors to ease the burden of routine calculations, so we must use all the new methods of science to simplify medical education rather than to complicate it. Let us remember that the pilot of an aircraft, holding a hundred lives in the hollow of his hand, needs little knowledge of the science of jet propulsion. The astronaut needs no astrophysics. On the terrestrial plane, most men and nearly all women who drive automobiles with skill and safety do so with only the most fragmentary knowledge of the internal combustion engine. In the same way, medical students should learn how to use the tools provided by modern science and as a matter of general education they should know in a general way how those tools work, but of detailed knowledge little more than that. They should know what a computor can do, but not how it does it. In order to use the electrocardiograph intelligently they must know all about the action of the heart but very little about the transistor. As men of education they must know something about the spiral structure of the cell nucleus and about the mechanism of chromosome abnormalities, but little or nothing about the chemistry of desoxyribonucleic acid and the chicken wire configurations of the steroid molecules.

But while it is easy to mouth such general postulates it is much more difficult to put them into effect, even though, as I

believe to be the case, they represent the views of all clinical teachers and most of the teachers in the departments of basic medical sciences. There is the stranglehold of the examinations where merit is judged on the basis of knowledge rather than wisdom and where, since a test of reasonable standard would be passed—perish the thought—by all the candidates, a test of unreasonable standard is imperative. There is the influence of textbooks, so often compendia of musty accumulations from the past, and, most pernicious of all, there is the influence of the narrow minded teacher, convinced that every detail of his own subject is essential to the progress of every one of his students.

In the past, tradition prescribed two principal instruments of clinical teaching, the systematic course of lectures and the routine hospital ward round. Both are out of date, but hitherto there has been no clear idea what should take their place. Lectures have their function, provided they are not 'systematic' and are given by teachers with a flair for attractive presentation; ward rounds should not be 'routine' but designed for effective instruction. In the future, perhaps audio-visual machines for self instruction may fill the gaps. But whatever techniques of teaching are adopted it is clear that the most pressing need is for the proper education of the teachers so that they may combine missionary zeal with sage discrimination.

THE PREREGISTRATION YEAR

After six years or more in the university or the medical school the newly appointed houseman has one clear objective, to settle down at last to the exciting business of treating patients. He says good-bye, with no pretence of reluctance, to lecture theatres, classrooms, and theoretical laboratories, and turns his attention to bedside examinations, to drawing blood samples,

undertaking special investigations, and assisting at operations. Without realizing it, during this period of intensive application to practical matters, he will learn a great deal about human nature and perhaps acquire some aptitude for human relationships. If he has the right spirit of dedication he will gladly work sixteen hours a day and stay on duty half the night.

But there is a clear duty upon those responsible for his training to see that his energies are properly directed and not overtaxed. It cannot be said that this duty is being discharged adequately at the present time.

Preregistration appointments were made compulsory by the Medical Act of 1950, which required that 'a person must after passing the qualifying examination have been engaged for the prescribed period in a resident medical capacity in one or more approved hospitals . . . '. The 'approval' must be given by a university or medical school. The postgraduate deans in 1957 approved various criteria including the number of beds to be under the charge of each houseman, the types of case (not solely specialist and not solely long-stay) the degree of supervision and the availability of laboratories and a library. It is a measure of the progress that has taken place since that time, (in some part due to generous endowment by the Nuffield Trust) that nowadays few of the hospitals where surgery is undertaken lack laboratories and a library, and few lack a senior member of the staff who is willing and competent to act as supervisor.

The Goodenough Committee which framed the original recommendations for making preregistration posts compulsory, emphasized that this period should be regarded as an extension of the phase of undergraduate training, and to this end it was recommended that the houseman's routine duties should be reduced in order to give him adequate time for study. It was

made the duty of the universities and medical schools to see that this was done. The Todd Commission in 1968 confirmed these objectives and recommended that the universities should exercise much stricter supervision than formerly.

Unfortunately, while universities and medical schools have always shown themselves willing to impose strict supervision upon their students they have failed entirely to supervise the conditions under which these graduate students are obliged to work. It is still true that in many hospitals the housemen are overtaxed and that much of their time is occupied by routine duties which are devoid of educative value. In some hospitals the housemen are required to spend much time (estimates vary up to two hours daily) on secretarial duties of various sorts, and much time (estimates vary up to one hour daily) on the routine task of withdrawing blood samples for laboratory estimations. Sadly enough, it is the old-established teaching hospitals which are the most inveterate offenders.

On other grounds also there is some basis for the claim that the major teaching hospital is not necessarily the best place for this phase of training, though it may well be so in the later phases. In some respects a good non-teaching hospital may well be more suitable for the preregistration phase. In a teaching hospital the houseman is the most junior member of a large team so his personal responsibility is correspondingly diminished. Unlike in former days, he is no longer the sole apprentice to his chief; he is at the beck and call of a host of seniors. In some teaching hospitals his duties are largely those of a clinical clerk and general factotum. By contrast, in a district hospital with its smaller staff the houseman is still given a good deal of responsibility. He is the direct intermediary between the consultant and the patients and is personally accountable for a good deal of the day-to-day care. He is a

person of some consequence in his small cosmos and he responds by developing a mature sense of responsibility.

REGISTRAR TRAINING

At the present time it is generally agreed that after the pre-registration period the graduate bent on a surgical career should hold a registrarship or comparable appointment for at least three years, and thereafter a senior registrarship for as long or longer. The Royal Colleges have laid down as a condition of entry to the second part of the fellowship examination a three-year period of registrar training which may be summarized as follows: (1) a year in a full-time hospital appointment in general surgery (or a rotating appointment giving a general experience of surgery) and (2) two years in hospital posts in general surgery or surgical specialties or both; or (as regards one of these two years) in the study of surgery or an allied science in a teaching hospital or research department. After acquisition of the fellowship diploma it is recommended by the Royal Colleges that he should undergo further training for an additional period of four years, which would normally be taken as a senior registrar. The training would be directed towards his particular specialty and guide lines for this phase of training have been issued by the various specialist associations.

Unfortunately although these guide lines are fully accepted there is no general plan for putting them into operation. There are problems of timing and availability. The trainee has to depend upon the chance that a suitable job will turn up at the right time and in the right place. He will have to seek a succession of posts in different units, perhaps in different hospitals under different authorities, and their conditions of service and

dates of starting and duration of tenure will be determined by service needs and may well be unrelated to his requirements for a proper training sequence. Then to cap the lot there is the tight bottleneck of entry to the senior registrarship.

Senior registrarships, unlike the junior posts, are recognized by the hospital authority as training posts and a definitive stage on the road to consultantships. The overall establishment of senior registrarships in the region, and the establishment in individual specialties, is determined from year to year in relation to the expected number of vacancies as judged by the known figures for retirements, the expected figures for death vacancies, the additions likely to be needed in expanding fields of work and similar criteria.

Most senior registrarships are located in or related to teaching hospitals, partly in order to be associated with teaching and research departments and partly to ensure equitable promotion prospects. In Scotland there is the further valuable provision that the senior registrarship is deemed 'supernumerary to establishment,' so in theory the trainee is not indispensible in the unit to which he is attached, and if it is desirable by reason of his need for training he can be transferred to another unit or another hospital or assigned to a research department or sent away on study leave.

Admirable as these arrangements are, one has the feeling that they are mistimed and misdirected. Most of the trainees by the time of their appointment as senior registrars have already had many years of postgraduate experience. They have already passed the final part of the fellowship examination. They have surely had all the formal education they require, and their only shortfall is in respect of independent responsibility. If their training has been defective in any other respect it is not their fault but the profession's.

THE NEED FOR A CO-ORDINATED SCHEME FOR REGISTRAR TRAINING

From what has been said it is clear that there is a need for a correlated system of registrar appointments which, while serving the primary purpose of providing for the care of patients, would also give an organized and coherent scheme of registrar training, so that in the course of a finite period registrars aiming at a career in general surgery or one of the surgical specialties would take a prescribed sequence of appointments providing the range and variety of experience suited to their needs.

There has indeed been tentative approaches to the solution of this problem, as indicated by the admittedly limited and patchy rotation schemes which have been put into operation in various parts of the country. One such scheme has been in operation for over fifteen years in the Glasgow region to the satisfaction of teachers and trainees alike and to the benefit of the hospital service. This limited scheme has included all the surgical registrarships at a teaching hospital (the Western Infirmary) and one registrarship each at the children's hospital and two district hospitals (in Paisley and Dumbartonshire respectively). The training period covers two and a half years and covers appointments for one year in general surgery and six months each in orthopaedics, paediatrics, and urology.

On the basis of this experience it is possible to specify the kind of scheme, subject to local variations, which should be introduced more generally. 1. There should be a formal sequence of appointments open to selected graduates aiming at careers either in general surgery or a surgical specialty. 2. All the surgical trainees in the region should be eligible to follow the same sequence or comparable sequences of appointments. 3. To clear the ground, only those trainees would be accepted

who had taken the primary fellowship examination and could therefore be expected to complete the course. 4. The complete scheme should cover a sequence of appointments over a three-year period, of which one year might comprise general surgery in a teaching hospital, one year in a district hospital, and a third year made up of shorter periods of attachment to various specialist units. 5. The scheme should be under the control of a supervisory committee of surgeons drawn from teaching and non-teaching hospitals in the region, which would survey the progress of the trainees and supervise their promotion from year to year. 6. To prevent a bottleneck at the end of the course the number of trainees should be calculated in relation to promotion prospects. 7. For trainees completing the course and deemed suitable to proceed there should be bridging arrangements to cover the gap to senior registrarships.

The need for such a scheme of comprehensive training had been advocated by the Todd Commission. Probably most surgeons would agree in principle that it should be adopted and most trainees would give it their enthusiastic support. But when it comes to actual planning every surgeon suddenly assumes the role of a *laudator temporis acti* and will brook no change in the existing order. It looks as though powerful action is needed by those in authority.

6

Surgery as an academic discipline

Surgeons have not always enjoyed high status and prestige in the academic world. Medicine has been accorded the rank of a university discipline since Salerno, but university degrees in surgery date from only a century and a half ago, and even now the difference is preserved by designating them Bachelorships or masterships rather than doctorates.

Nor in the past have surgeons in their individual capacity been much inclined to sip the Pierian spring. In the eighteenth-century the physician William Hunter was a scholar and a connoisseur of literature and the fine arts; his surgical brother was a plain uncultivated man whose lack of education was only redeemed by his insatiable spirit of enquiry. In the ninteenth century Mr Pickwick's young friends from Guy's Hospital were no bookworms. In the present century surgeons have too often been content to aim at skill in craftsmanship or, at the most, at unexciting researches conducted in the dissecting room or the pathology department.

Prior to 1948 the universities and medical schools were concerned only with undergraduate education and even in this limited field their responsibility was most evident in the earlier parts of the curriculum. They controlled the preclinical disciplines of anatomy and physiology, and later the paraclinical disciplines of pathology and pharmacology, but the subsequent training in clinical work was farmed out to the hospitals in much the same way as engineering students were farmed out for training in industry. But since the Health Act came into

force the influence of the universities and medical schools has spread more widely into the hospital wards and departments.

SURGICAL RESEARCH

The intrusion of university teachers into the hospital environment has had its most notable effect in the field of research. Thirty years ago few surgeons undertook research, outside the few whole-time units which were then just beginning to make headway. And with a few exceptions such surgical research as was undertaken was directed towards clear-cut, practical ends. By contrast, every medical school now has its surgical research department, with equipment, technical staff and facilities for experimentation which bear comparison with the majority of purely academic departments; and much of their work is directed to fundamental problems concerned with living processes and the nature of disease. This change is reflected in the proceedings of surgical societies, which commonly include papers on such subjects (to quote some recent examples) as the effect of aldosterone on paradoxical aciduria, the fate of 5-hydroxytryptamine in the lungs, or the action of polypeptides on biliary flow. Part of this development springs from a growing realization of the value of close co-operation on equal terms with physicists, organic chemists, and endocrinologists.

The change is reflected also in the attitude of appointments committees. Formerly, apart from a few of the more academically minded of the teaching hospitals, a candidate for a junior hospital post would gain little advantage from having carried out original research and he might even suffer from it. By contrast, at the present time there is, at any rate in the more enlightened parts of the country, a growing appreciation of the spirit of enquiry and a research background is almost a *sine qua non* for surgical advancement.

Critics might be inclined to question the merits of this development. Valuable though it might be from the point of view of pure science, is research work on fundamental problems really suitable for trainees with ambitions towards a practical career in surgery? Should not young men with a genuine interest in enquiries of this sort be directed towards a more strictly academic discipline? In any case, is a hospital department, however well stocked with equipment, the most appropriate place for such researches to be performed?

I believe that such criticisms are misplaced. Experience of the past few decades has shown that surgeons with an enquiring mind will find in their clinical work many promising lines of research and if they are given the facilities they will make use of them. Moreover there is no doubt that training in research methods inculcates an attitude of scientific scepticism and a desire for accurate evidence which can be of inestimable advantage in fostering good clinical judgment. The follow-up surveys and therapeutic trials and the detailed assessments of operation results which are so common nowadays provide evidence that this kind of discipline is already bearing fruit.

The value of research attitudes in surgery is well seen in relation to diseases of the stomach. Reference has already been made to recent progress in the surgical treatment of uncomplicated peptic ulcer. The complication of acute perforation of peptic ulcer shows how simple clinical observations can lead to advances in the remote field of epidemiology. Early in the course of the Second World War it was noted by surgeons in various parts of the country that the incidence of perforated ulcer seemed to have risen. It is comparatively easy to obtain accurate evidence on this question, for the symptoms of perforation are so clamant that practically all cases are sent to hospital and the diagnosis is so straightforward that the hospital records can be relied upon to give accurate data. It was soon possible to

confirm that the increase in incidence of perforations was a true one. From this point, surgical interest was aroused in the wider question of the incidence of perforations in different countries and at different times, and researches have been conducted both retrospectively as far back as the turn of the century and prospectively up to the present time, with results which may well have some bearing upon wide questions regarding the cause, and consequently the prevention of this disease.

Another example in which an enquiring surgical mind has led to profound scientific results is illustrated by the trail which led to the isolation of the hormone gastrin and the subsequent synthesis of pentagastrin. In 1955 Zollinger and Ellison reported the cases of two patients with severe peptic ulceration who also had a peculiar form of tumour of the pancreas, an adenoma of the pancreatic islet tissue. It was their special merit to recognize the connection and to infer that some kind of a hormone secreted by the tumour must be responsible for stimulating the highly acid gastric secretion and thus indirectly leading to the formation of the ulcer. It remained for Gregory in Liverpool to extract the hormone in pure form, to demonstrate its secretogogue effect (a thousand times greater than histamine) and to identify it with the hormone derived from the gastric antrum which is responsible for the normal acid secretion.

The significance of this discovery of Zollinger and Ellison is not simply that of an interesting side effect of a rare pancreatic tumour, but lies in the later developments, for the isolation of gastrin has been the starting point for a new and lengthy series of laboratory and clinical researches which have thrown a flood of light on the whole subject of the gastric secretion.

Such a dramatic story is, of course, rare. More often the stimulus to a piece of research comes in a less exciting form. Dissatisfaction with a particular form of treatment, or un-

certainty as to the choice between two operative techniques may provoke a surgeon to undertake a series of follow-up investigations or to organize a therapeutic trial. A good example of investigation of this sort is seen in relation to the choice of operation for peptic ulcer, and the surgical literature of the past twenty years contains many examples of valuable studies in this field. It is a measure of the complexity of the problem that despite the multiplicity of such investigations this particular question remains unsolved, for all the enquiries show that the different types of operation yield results between which there is remarkably little to choose. Perhaps this is just as well, for it enables every surgeon to continue in the confident belief that the type of operation which he himself practices is the best.

THE UNIVERSITY INFLUENCE IN HOSPITALS

No-one would accuse the universities of undue devotion to business efficiency, but in the days before the health service was introduced their teaching arrangements did at least compare favourably with those of the hospitals. A university vice-chancellor, accustomed to the tidy administrative structure of his academy, with its unified organization of clearly defined departments, each with its hierarchy of a professor with his lecturers, must have been appalled at the chaotic state of the clinical teaching world, with its multiplicity of independent and contending hospitals, each with its multiple units of diverse purpose under the control of independent physicians for whom the education of students was not the sole or even the primary avocation. However, that situation has now been changed. The reorganization of the hospitals brought order out of chaos, and by one of the wiser provisions of the Health

Act the universities and medical schools were given an influence in hospital affairs unprecedented in this country or indeed anywhere in the world.

Inevitably a change of this sort could not be achieved without resistance or at any rate without remonstrance, and there were potent possibilities for disagreement between university appointees on hospital staffs and those promoted by the hospital authorities. This is not surprising for there was a fundamental difference of outlook and aim. The primary duty of clinical workers appointed by the hospital authorities is to provide for the day-to-day service to patients and the requirements of medical education and research must take subordinate place. The primary duty of academic members of the staff is to provide education for the junior men and undertake research for the benefit of future generations. It must be a cause for congratulation that the occasions for conflict between these different standpoints have been so few and so easily resolved.

It had been clear from the outset that resolution of the conflicting standpoints of academics and non-academics on the hospital staffs might proceed along either of two quite different lines. On the one hand it would be possible to establish two estates, side by side within the hospital polity, the one subserving mainly academic interests, the other devoted mainly to clinical work. There would be the small estate headed by the clinical professors, with their small retinue of lectures, assistants, and researchers appointed by the university, charged with a large teaching commitment and possessed of a modern research laboratory but with only a limited number of beds and few outpatient responsibilities; and there would be the much larger estate of surgeons, physicians, and specialists appointed by the hospital authorities and concerned mainly with carrying the major load of routine clinical duties. The natural development in terms of present-day organization would be to

establish, on the surgical side, two separate divisions, the one comprising the professors of surgery, anaesthetics, orthopaedics, and so on, with their junior academic staffs and researchers, the other comprising all the rest of the hospital surgical staff.

In contrast with the isolationist attitude implicit in such a scheme there would be the alternative plan which would aim at unification, or at any rate symbiosis of the academics and the non-academics, whereby the professors and their associates would throw in their lot with the rest of their colleagues with the aim of gradually moulding the whole structure towards a common development. This plan would imply that the academic influence would be exerted not by the imposition of authority but by persuasion and agreement.

It is clear that in the long term this latter way of progress is the more worthy one, and it is satisfactory to note that in most medical schools and teaching hospitals in the country it is now in process of realization.

The ease with which it has been accomplished has depended partly upon the circumstances prevailing in different parts of the country. In Scotland since the turn of the century the clinical professor appointed by the university or by the crown has enjoyed a prescriptive right to a hospital charge and in some cases the professor's teaching and research department has been located within the hospital grounds or even 'embedded' in the hospital building. Moreover, in Scotland there has been a long tradition of clinical teaching, where every consultant on the staff of a teaching hospital counts it his duty to devote much time and preparation to the instruction of his students and where, to tell the truth, there have in the past been some who have outshone the professor in this field. Consequently it is not surprising that in such schools a university appointee is accepted by his colleagues on the hospital staff as

a person of like ideas who, if so minded, may be permitted and indeed expected to exert an imposing influence in hospital affairs. In other parts of the country the teaching hospitals have had no such lengthy indoctrination, so the introduction of academic members on to the staff has necessarily taken place more slowly and less completely. Nevertheless the process has continued satisfactorily, and the situation where the professorial unit remains as a small isolated enclave within an unheeding environment is now fortunately rare.

Of persisting causes of friction the most difficult to resolve is the problem of the different conditions of service applicable to junior men. On the one hand there are registrars and senior registrars appointed and employed by the hospital authorities, and on the other hand lecturers and assistants appointed and employed by the university. They work side by side at much the same kind of tasks, but with different conditions of service, different salary scales, and different prospects of promotion. The lecturer is likely to have been appointed by virtue of his academic record from a wide, perhaps a nation-wide field of applicants. He will enjoy greater opportunities for research and self-advancement, and the prospect, if his fortune holds, of ultimate promotion to high rank and reward. But in the meantime his opportunity for practical experience is less, and his salary also may be less, than his registrar colleague. By contrast, the registrar sees himself as a hewer of wood, carrying the full load of the hospital chores, undertaking routine duties which are invaluable to the hospital but of little help to his own career, and in an appointment which though adequately paid carries no guarantee of permanence or promotion.

It might be thought that the problem could easily be solved by putting the two types of trainee on the same basis, that is to say with a unified appointment system and comparable conditions of service. But from the university side there are two

powerful arguments against such a solution. First there is the argument that a university or medical school can attract candidates of greater merit from the country as a whole and is likely to be less influenced by exclusively local considerations than the appointments board based upon a single hospital. And secondly there is the argument that as in every other university department it is essential for proper devotion to the aims of teaching and research that the professor should be able, in effect, to pick his own men and guide them along the right path.

This is a thorny problem, but it would seem that the modern divisional structure of hospital staffing might offer a solution. From the university point of view it would mean acceptance of a joint plan, applicable to university lecturers and hospital registrars (and senior registrars), with equated salary scales and similar conditions of service. It would mean some kind of reciprocal agreement on appointments procedure, and it would mean acceptance of the idea that, once they have been appointed, the lecturers and registrars should be equally eligible to share the advantages of the university connection. From the hospital point of view it would mean acceptance of the idea that the university professor would act as principal agent of the hospital division in relation to the education and training of registrars.

In such a scheme as this, the professor of surgery, who might be chairman of the division or at least deputy chairman, would act on behalf of the division as supervisor of registrar activities and on behalf on the university as supervisor of lecturer activities. The lecturers and registrars would be allocated to similar duty rosters and rotation sequences to ensure that they would gain proper training and experience in surgical craftsmanship and they would share to an equal extent all duties connected with undergraduate education. Those from either category who

exhibited an aptitude for research would be equally eligible for allocation to laboratory duties or special study courses. It is the kind of plan from which in the long term both the university and the hospital would benefit.

7

Conclusion

During the 750 years of its existence, practitioners of the 'Sanguine Mystery' have done much to advance this department of the healing art. In this monograph I have attempted to review recent developments and speculate on future progress in surgical practice, research, and teaching.

As part of these developments I have attempted to indicate also the recent change in character of the 'mystery' itself, which has led to a functional re-alignment of physicians and surgeons. They no longer belong to two separate disciplines, distinguishable respectively by the possession of a scalpel or a stethoscope. Indeed nowadays it is usually the physician who draws blood and passes the intravascular catheter, while the surgeon may discuss the significance of a murmur or assess an electrocardiogram. Increasing specialization has encouraged this kind of development, for specialists tend to become expert in everything connected with their specialty and more remote from surgical developments in other spheres of work. The neurosurgeon knows a great deal about neurology but is out of touch with the surgeon who practices gastro-enterology; the orthopaedic surgeon knows more about rheumatism than about heart surgery.

This is all to the good. The old order has outlived its purpose. A surgeon now is truly a physician with an aptitude for a particular kind of therapeutic regimen. It is a development of which Rock Carling was himself a forerunner and which would command his warm approval.