The establishment of an accident hospital completely segregated from the services of a general hospital was fortuitous. The disadvantages of isolation were recognized at the time, but the opportunity first to study the treatment needs of all types of injuries, unhindered by other medical responsibilities, and then to establish a hospital organization to meet those needs, far outweighed the disadvantages of segregation. When these requirements were known and recognized it was considered that the next stage of development would be the establishment of comprehensive accident departments alongside large general hospitals.

Three inter-related events led to the foundation of the Birmingham Accident Hospital.

1. The 300 bedded Queen's Hospital (founded in 1841) became redundant as an undergraduate Teaching Hospital, on the opening of the Queen Elizabeth Hospital.

2. In 1936 the hospital problems posed by ever increasing numbers of injuries became so grave that an Interdepartmental Government Committee was appointed to examine the hospital facilities then available for the treatment of accidental injuries. After a three-year survey that committee reported in 1939: 'The most striking feature is the situation disclosed as regards delay in many cases, even cases of serious injury in commencing treatment'. The committee left unanswered the hospital organizational requirements essential to the prevention of such delays.

3. The hospital accident services of Birmingham were similar to those of the rest of the country; they were inadequate.

On the outbreak of war, the proposal to establish an accident hospital within the old Queen's Hospital was temporarily shelved. Then the situation became critical. With the influx of unskilled labour to Birmingham's factories the incidence of industrial injuries suddenly increased by 40%; to this additional injury load was added civilian air raid casualties. An emergency decision was taken to open the Queen's Hospital as an Accident Hospital on April 1, 1941. On that date a hospital changed its name and its purpose. It had yet to develop an organization to meet its new commitments. The guiding committee responsible for the opening of the accident hospital conceived it as one for the treatment and rehabilitation of industrial injuries. Since it was the last voluntary hospital to be founded in this country this conception had obvious financial attractions. In the event industry very generously responded to appeals for capital development and maintenance costs.

After the hospital opened the agreed principles of its development were outlined in its first annual report published in 1942.

1. Primarily the hospital shall serve the accidents of industry.

2. Working as a base hospital for all industrial injuries, it will accumulate records of value affecting treatment, rehabilitation and accident prevention.

3. The hospital shall be a training school for industrial nurses and ambulance staff.

4. The hospital will treat accidents occurring outside industry.

5. It will be a teaching hospital for undergraduates and post-graduates.

6. By rebuilding and reorganization it is anticipated that the hospital will eventually treat the majority of serious injuries in and around Birmingham.
In the course of the following years most, if not all, of these objectives were achieved. Although the emphasis on the care of industrial injuries was maintained, from the day of the hospital's opening, all types of injuries were treated. Clearly it is not important where a worker is injured, the important consideration is his return to working competence without undue delay. This principle also applies to members of the workers' family.

The rebuilding and reorganization of an accident hospital whilst it was receiving ever-increasing numbers of patients, presented some difficulties. A record of the establishment and subsequent development of its various departments is interesting, as an example of the provision of essential facilities in the order in which they were needed, and this under the additional restrictions of labour and materials enforced by war-time economies.

In 1942 alterations, amounting to a substantial rebuilding programme within the very large waiting hall of the old Queen's Hospital and its various adjoining rooms, were commenced to provide the first essential need of an accident department—a reception area for the injured and adjoining arrangements for their surgical after-care.

The reception area was planned and built in two inter-communicating sections, each providing all facilities for the clinical and radiological examination and immediate treatment requirements of its patients. Both departments were sited on the ground floor adjacent to the main entrance of the hospital.

It was accepted that almost all of the hospital's patients would be received direct from their accident without previous medical examination or treatment. This is the fundamental difference between the organizational requirements, at admission level, of an accident department from those of a general hospital. The latter's patients are generally referred to hospital after previous medical examination and often after treatment.

The two inter-communicating sections of the reception department are:

1. A department for the reception of ambulance-transported serious injuries. This opens directly from a separate covered ambulance porch. Initially it provided equipment and staff essential to the full examination and emergency surgical treatment of two patients at one time. But such has been the increase in severity and multiplicity of injuries from road accidents that in 1959 the department was extended to an eight bedded ward, more accurately described as an intensive therapy unit, wherein all major injuries are admitted, examined, treated and retained until fit for normal ward care.

2. The larger section of the adjacent reception department is for the more numerous less seriously injured. It contains seven examination cubicles, its own X-ray department, and three intercommunicating operating theatres for the immediate full treatment of the common soft tissue injuries and the common fractures.

Approximately 90% of an accident hospital's patient load is the 'walking wounded' who can be treated in continuity as out-patients. 10% of the patients will be more serious injuries, some requiring intensive care immediately on admission, all requiring periods of in-patient treatment and many needing major operating-theatre facilities. The wards and the major operating suite of the old Queen's Hospital provide the required additional facilities.

Such self-contained reception departments represent the first organizational need in any large accident service to prevent delays in commencing treatment. As the hospital's load of minor injuries increased it was necessary to add to the admission department a short stay ward for pre-operative preparation before minor surgery and post-operative recovery. A short stay ward is also needed for the few hours observation of doubtful lesions, particularly the common 'minor' closed head injuries.

The next organizational need in the prevention of delays concerns surgical after-care. In the immediate proximity of the reception department (and again on the ground-floor) a self-contained out-patient department was built with inter-communicating examination rooms, plaster theatre, radiological department and redressing stations. Again the important principle of building treatment facilities immediately around the patient was followed.

The patient-load and time of admissions in the reception department can never be assessed, this department must be staffed over the 24 hours of each day; one of the peak periods of admission of the more serious road accidents is between 10 p.m. and midnight.

However, out-patient after-care can be organized on an appointment system, and the total patient flow to the ground floor of an accident department is in some measure, controllable.

During 1942 a small Medical Research Council unit was established to study the epidemiology of wound infection, particularly of very minor wounds treated in continuity by the industrial medical and nursing services. This study led to a revision of wound cleansing and dressing techniques in and outside the hospital, and the planning of more efficient dressing stations. In the planning of dressing stations, the same principle of building around the patient and facilities required for treatment was followed.

Over the succeeding years the initially small Medical Research Council unit developed into a well staffed industrial injuries and burns research unit under its own director, concerning itself with advances in treatment and the prevention of injuries in collaboration with the hospital's clinical staff. Since 1961 it has collaborated with the work of the 'Road Injuries Research Group', relating the nature of road injuries with the causes of those injuries, in order first to gain basic information necessary to the reduction of the present severity of road injuries, and next to study the treatment needs of severe multiple injuries.

The Pathological Department

Initially the Medical Research Council unit was responsible for the routine hospital bacteriology, but as the unit's research projects expanded as the hospital developed, a separate pathological department became necessary. Such a department differs only in the tempo of its services from similar departments in other hospitals. Blood
grouping and blood chemistry are often very urgent requirements. Constant wound swabbing to recognize the contaminants in all open wounds, particularly in burns, and sensitivity tests for appropriate antibiotics, are routine and often urgent matters. The careful control of anticoagulant therapy to prevent pulmonary embolism, particularly in ageing injured patients, is an important consideration.

The constant supervision of the many aspects concerned in the control of hospital infection and cross infection is a particular concern of this department.

Routine autopsy examinations of all who die from injury and the subsequent discussions with clinical staff are, perhaps, the most valuable of all studies leading to the better understanding of the detailed and often complex nature of injuries and their complications. Such study-discussions uncover what may be called the detailed 'anatomy of injury' upon which all rational treatment is based.

Table 1 is a gross statement of the nature of injuries in 500 autopsies following road accidents—evidence indicating some of the problems of treatment and of prevention in this, the most serious aspect of the 'accident epidemic'.

It is of interest to reflect that research into the many problems of accident treatment and prevention had, to a very large extent, been neglected by the hospitals of this country, due to the inadequate facilities for treatment and the almost total absence of research units. Yet once given the opportunity, research received a high priority in this hospital's development, and the need was immediately accepted and subsequently strongly supported by the Medical Research Council.

The Rehabilitation Department

The rehabilitation of an injured person com-

<table>
<thead>
<tr>
<th>Category of Road User</th>
<th>Fractures</th>
<th>Major Soft Tissue Injuries</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spine</td>
<td>Brain</td>
<td>Serious Blood Loss</td>
</tr>
<tr>
<td>Pedestrians</td>
<td>38</td>
<td>161</td>
<td>112</td>
</tr>
<tr>
<td>Riders of motor cycles, scooters or mopeds</td>
<td>18</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>Pedal cyclists</td>
<td>3</td>
<td>36</td>
<td>8</td>
</tr>
<tr>
<td>Vehicle occupants</td>
<td>8</td>
<td>85</td>
<td>5</td>
</tr>
<tr>
<td>Total injuries</td>
<td>67</td>
<td>359</td>
<td>237</td>
</tr>
</tbody>
</table>

If these principles are accepted then it is advisable to provide adequate facilities for the surgeon's supervision of the whole phase of hospital rehabilitation. To this end the rehabilitation department was built in closely communicating sections for physiotherapy, remedial gymnastics and occupational therapy, and contains a room where the surgeon discusses the progress of his patient with the head of each rehabilitation section, with the Almoner in attendance to arrange the stages and time of final resettlement at work. The Almoners' rooms were planned as a part of the rehabilitation department.

The planning and building of the hospital's rehabilitation section in 1943, corresponded to the time when the Minister of Labour (the late Ernest Bevin) was actively pursuing a national policy, to provide full facilities in and outside hospitals for the rehabilitation of the disabled of both war and industry. As a result a large department, occupying approximately one sixth of the hospital's available floor space, was built. This is an over-generous allocation.

In the same year (1943) with the co-operation of the Austin Motor Company, the first industrial rehabilitation centre was opened within a factory environment. There, normal production machines were modified to provide the necessary repetition exercises to regain the range, power and speed of movements necessary to factory re-employment. Industrial rehabilitation, at factory level, is undoubtedly the most economic
approach to rehabilitation, for saleable goods can be produced, wages paid, and the injured cease to regard themselves as hospital patients on return to their normal working environment. The difficulties of extending such schemes are that very few factories are large enough employees to sustain such a service, and intimate communications with hospital surgeons are hard to maintain.

The Burns Unit

In 1943 it became obvious that injuries from burns and scalds, particularly those involving large body areas, present special problems both in the urgency of treatment to prevent dangerous degrees of plasma loss, and in the bacteriological contamination of these very large open wounds. Further problems concern subsequent hospital infection and the need to close these open wounds at the earliest stage. The nursing and nutritional requirements of large area thermal injuries also present special difficulties.

A small burns unit was therefore established in segregation from other wards, and the Medical Research Council provided the necessary research staff to study the general and local effects of thermal injuries. Within a year, such was the call from other hospitals for the early transfer to the unit of their more serious burns, that the unit was enlarged, until now it is to a large extent a regional unit. It contains 36 beds, a 'clean air' dressing station, and its own research facilities.

The Clinical Staff

The primary objective of the hospital has always been the provision of a 24-hours-a-day immediate availability of surgeons experienced in the care of all degrees of injury to all parts of the body. This in effect means the appointment of surgeons with sound general surgical training and with special experience in orthopaedic and plastic surgery, preferably young men physically capable of meeting the peculiar tempo of their responsibilities at any hour. Such surgical staff and their essential residents must be supported by equally well trained anaesthetists and their residents.

Although the hospital, between 1941-1946, was allowed a minimum of staff, in 1947 the Central Medical War Committee gave its permission for the appointment of the full staff. In that year, the hospital, originally planned for a patient load of 25,000 acute injuries each year, received over 34,000 such injuries. The yearly patient load subsequently rose to over 50,000 acute injuries. These numbers are now decreasing with the opening of small accident departments in many neighbouring general hospitals.

Accident surgery is a demanding service, if the objective is to meet a 24-hours-a-day service complete in every detail. Accordingly the hospital's staff is divided into four teams, each comprising two consultant surgeons, one consultant anaesthetist and their supporting registrars and house officers. Three of the teams are concerned with the general accident service, and the fourth with the burns unit.

Each general surgical team is on a three-day rota. For 24 hours it is responsible for all admissions (varying between 100-200 a day), the next day's duty mainly concerns out-patient and rehabilitation after-care, and the third day is occupied with pre-arranged operating lists. Each team makes at least one daily ward round.

The burns unit follows a somewhat similar arrangement of daily duties.

The consultant staff of each team is entirely responsible for the total care of their patients from admission onwards. They are supported by other consultants in the special divisions of surgery and medicine. The relationship between the hospital teams, consultants and the specialist consultants is interesting.

Injuries, particularly the more severe types of road injuries can occur to any and often to many parts of the body in any one patient. The treatment of many multiplicity of severe injuries can be the most urgent of any surgical emergency. Immediate treatment, on admission, may involve the restoration, by various surgical procedures, of adequate respiratory function in severe chest injuries, to the early replacement of a reasonable, preferably normal, blood volume, the covering of open wounds and the splinting of fractures. These measures are often essential preliminaries to the diagnosis of various "hidden" injuries, by observing, at frequent intervals, the patient's responses to these measures of surgical "first aid".

Early radiological examinations of the patterns of associated bone injuries, particularly of the head, chest, spine and pelvis are also helpful in assessing the probabilities of underlying soft tissue injuries, as are the radiological appearances of soft tissue structures and other "shadows" in the chest and abdomen.

This is the clinical field of surgeons experienced in the early hospital care of severe injuries, surgeons who are capable from experience, of diagnosing the nature of all injuries and their priorities in plenary treatments and if necessary meeting all plenary treatment requirements.

The diagnosis of the nature of injuries to the brain, chest and abdomen, in a deeply unconscious patient is one of the most difficult surgical exercises.

Without the immediate availability of experienced surgeons I cannot see how delays in 'commencing treatment even of serious injuries' can be avoided.

When, in the opinion of such a receiving surgeon, the nature of a severe injury to the head, chest or abdomen requires the immediate technical skills of a specialist in any of these fields, that consultant is called in and given the reason why his services are urgently needed.

Since the established specialist divisions of surgery can never be developed to provide emergency surgical treatment for all types of injury within their particular field, then they should be used only for those severities of injury requiring their special skills.

There is still a great deal of criticism of the development of yet another specialist division within surgery—the 'accident surgeon'—mainly because he cannot be trained in all the advanced technical operative fields of surgery. Yet if the proposed comprehensive accident departments are to meet the particular needs of the injured without delay, then 'accident surgeons' would seem to be essential, at least they have proved themselves essential to the development of the Birmingham Accident Hospital.
The Accident Epidemic

Each year, 3½ to 4 million injured people are treated in the hospitals of this country; between 300 and 400 thousand of these injuries will be serious. Accidents have therefore reached epidemic proportions and surgery is vitally concerned. The road-accident component of the epidemic is increasing and will increase still further as the volume of road traffic increases. Road injuries present the more difficult surgical problems both in the severity and multiplicity of resulting injuries.

The nature of car-occupant injuries on our developing motorways as compared with other roads is shown on Table 2. It is probable that the risk of severe and fatal injuries to car occupants per vehicle-mile is greater on motorways than on any other type of road.

In an analysis of over 10,000 road injuries occurring in and around Birmingham and received by the Birmingham Accident Hospital, one in six was serious and one in 12 of the serious injuries was fatal. These are much higher serious and fatality rates than the hospital experiences following any other type of injury-producing accident.

Basically the surgical problems awaiting solution concern a new tempo and quality of treatment and new standards of timing and team work, commencing with the quality of first-aid attendance at the accident site and the gentle transport to accident departments where, on admission, immediate adequate treatment can be assured.

The comprehensive accident department here described should be sited alongside a general hospital with all available specialist services immediately at hand. Yet such a department is a practical and economic proposition only if it receives large numbers of patients, and is therefore appropriate only in the heavily populated areas of some cities. In a coordinated national hospital accident service it would be the central accident unit of the three-tiered scheme advocated in the ‘Interim Report of the Accident Services Review Committee of Great Britain and Ireland’.

Research, Teaching and Records

Research and teaching are important functions of all comprehensive accident departments. Special research units are probably better allocated to a few of the bigger departments, but research facilities to advance methods of treatment and accident prevention should be available to all.

Efficient hospital record departments and adequate secretarial help to report the work of clinical, research and laboratory staffs, so that each history can be used for the benefits of teaching and research, are essential to continued progress in the treatment and prevention of accidental injuries. The Robbins Committee on higher education recommended ‘more secretarial workers to set every available teacher free for teaching’.

How much more important is secretarial help to set consultants free to concentrate their special skills on the urgent problems of treatment and to help them to accurately record the details and end results of such treatment.

Since its foundation the accident hospital has used adequate secretarial services to allow its staff to give their undivided attention to patient care and the resulting clear records of treatment and their easy availability from our records department have been invaluable for research and teaching purposes.