Interfaces between medical specialties

Rehabilitation medicine

JA Cozens, MA Chamberlain

Summary

The nature of rehabilitation medicine is outlined in terms of its objectives, its methods, the patient groups which it seeks to help and its relationships to other specialties. Some major advances of recent years are discussed, such as the development of the impairment/disability/handicap framework. With particular emphasis upon neurological rehabilitation, the breadth of the specialty is then illustrated with examples of current preoccupations. These include recovery patterns of the damaged nervous system, testing the efficacy of existing therapies, applying new treatment techniques and developing quantitative measures of disability and handicap. Looking to the future, some key areas are identified where further advances might be sought.

Keywords: rehabilitation medicine

Introduction

Now is an appropriate time to review the state of rehabilitation medicine in Britain. Increasing numbers of patients survive acute disease or injury and live to experience disability for lengthening periods. Moreover, the traditional sources of support for these individuals are coming under strain: within hospital practice, the high burden of chronic disease is adding to pressure on acute medical beds; within the community, the first cohorts of spinal injury and spina bifida survivors are seeing their parents age. Against this background, there is growing interest in patients' quality of life, including consideration of treatment outcomes in more functional terms. Rehabilitation medicine has much to offer in reducing the burden of disability and enhancing the quality of life of those with residual disability. This paper looks at what is available from rehabilitation medicine (particularly neurological rehabilitation), and how it relates to other specialties.

WHAT IS REHABILITATION MEDICINE

Rehabilitation has been defined in general terms as 'restoration to some degree of normal life by appropriate training' (Oxford English Dictionary). With specific reference to medicine, definitions have encompassed 'all means aimed at reducing the impact of disabling and handicapping conditions and at enabling disabled people to achieve optimal social re-integration' (World Health Organisation). The latter aim of enabling places the patient at the centre of the rehabilitation process.

Rehabilitation medicine applies all the components of the conventional audit cycle to the individual patient (*viz*, assessment – definition of goals – intervention – review). The process usually starts at the direct access outpatient clinic, where a full clinical history is taken, including employment and social aspects. A functional history is also obtained, covering personal and domestic activities of daily living in order to assess the patient's ability to fulfil family, social and occupational roles. The history is then complemented by a full physical examination in order to assess the effects of the disease itself and to identify the associated impairments and consequent disabilities. At this stage, the patient's perceptions are considered: 'Why have you come?' 'What would you like me to do for you?' are questions which produce a focussed response that allows the doctor to distill key problems and agree priorities with the patient and carers.

Armed with the above clinical assessment, investigation and management can be planned at up to four levels: disease, impairment, disability and handicap. Since patients may be referred with longstanding diagnostic labels of uncertain origin, the nature of the disease itself may need to be confirmed. Any treatment should be reviewed and preventable risk factors discussed. Specific impairments (such as spasticity) may be ameliorated by a combination of physical therapy and medication. Disability may be reduced by retraining (as in gait) or modification of the task (as in elements of personal care). These interventions at the impairment and disability levels may suffice to achieve a satisfactory reduction in the handicap experienced by the patient, but in many cases handicap itself requires direct consideration. Handicap is governed by the patient's environment and role in society (see below). Technical aids and adaptations to home and work may reduce the mismatch between patient and environment (figure). An understanding of the patient's social role may permit a further reduction in mismatch: what is the core of the role which must be preserved? How much can be dispensed with or altered? Are there peripheral aspects of the role which can be fulfilled by others?

As with all good clinical practice, the rehabilitation cycle is closed by reassessment after intervention. This naturally examines existing goals, but may also proceed to establish new goals. Although new goals may mark the route towards greater independence, they must sometimes reflect disease progression; in the latter situation, presenting goals as positive targets may call for considerable skill from rehabilitation staff.

**Rheumatology and Rehabilitation
Research Unit,
University of Leeds, UK**
JA Cozens
MA Chamberlain

Correspondence to JA Cozens,
36 Clarendon Road,
Leeds LS2 9NZ, UK

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HEALTH

Individual and environment matched

DISEASE

Mismatch

TREATMENT

Impairments and disabilities reduced

RE-INTEGRATION

Physical and social environment adapted
Residual mismatch filled by equipment and services

Figure The process of rehabilitation (courtesy of Dr B Bhakta)

Community rehabilitation resources

- ability development centres
- community clinics
- disabled living centres
- disablement information advice lines
- services for young adults
- stroke rehabilitation schemes
- volunteer stroke schemes
- younger disabled units

Box 1

Special interests within rehabilitation medicine

- bioengineering
- epidemiology
- environmental controls
- neurology
- neurophysiology
- orthotics
- prosthetics
- psychology
- rheumatology
- seating
- spinal injuries
- urodynamics

Box 2

Major concerns

- multiple disability
- disability requiring technical intervention
- evolving handicap (progressive disability or changing circumstances)

Box 3

The specialty of rehabilitation has responded to the trend towards community-based healthcare in Britain. Disabled people certainly want to be supported in the community and it is now possible to offer a dynamic community-based approach to reducing disability and handicap, rather than merely long-term support. This is seen in the development of multi-disciplinary clinics, involving a liaison health visitor who attends the patients in their homes and can also contribute to team management in the hospital out-patient department. Consultants in community rehabilitation extend this approach to include clinics hosted by local health centres and reinforced by a bedbase at a Younger Disabled Unit. These units offer intermittent rehabilitation rather than simply respite relief; this is particularly appropriate for progressive conditions such as multiple sclerosis, but may also be applicable to stable pathology such as stroke if periodic therapy is required to maintain optimum gait or posture. Younger Disabled Units are part of a network of community resources which also includes Disablement Information Advice Lines and Disabled Living Centres (where a wide range of aids and appliances may be tried with professional advice and no commercial pressure).

The Community Care Act calls for a seamless, client-centred service. This places particular demands upon the hospital-community interface (including Social Services). Rehabilitation has been in the forefront of discharge planning and has developed novel strategies to assist the return of patients to their homes. A notably successful example is the Stroke Rehabilitation Scheme, whereby patients are discharged initially to the homes of trained carers who monitor and guide their re-learning of domestic skills.¹

Rehabilitation is a multi-disciplinary specialty, but the doctor is closely involved with the patient at each stage of the process. As well as monitoring the disease itself and supervising pharmacological interventions, he or she often has a catalytic role to play in ensuring that an adequate range of services is planned for the disabled patient and that interfaces between hospital services are bridged, as well as those between hospital, general practitioner, community services and employers.

WHAT CONDITIONS DOES IT COVER?

The principles of rehabilitation are not disease-specific and its techniques may potentially be applied to any disabling condition. Although the most prevalent disabling conditions are musculo-skeletal, neurological disorders more commonly cause severe disability. Hence the following groups of patients have been identified towards whom the efforts of a consultant in rehabilitation medicine are particularly directed:

- patients with multiple disability, especially caused by head injury, multiple sclerosis, stroke and cerebral palsy.
- patients with disabilities requiring complex technical intervention which may involve several clinical specialties (such as amputees).
- patients whose situations are evolving either because of progressive disability (due to the underlying condition or advancing age) or changing circumstances (such as leaving school or loss of a carer).

Regardless of patients' primary pathology, the presence of associated conditions such as heart disease in stroke and secondary conditions such as urinary disturbance in multiple sclerosis require the rehabilitation physician to maintain a broad expertise.

WHAT IS THE CAREER STRUCTURE?

Although rehabilitation medicine is a new specialty, it already has its own accreditation scheme and Standing Advisory Committee. Trainees largely enter at Senior Registrar grade after attaining MRCP, although some possess FRCS. The training programme provides a broad experience mainly in neurological and rheumatological rehabilitation, as well as special areas such as prosthetics and spinal injury. Technical training is also required in special seating, orthotics, environmental controls and communication aids. There is a particular emphasis upon development of the management skills needed to deploy a wide range of resources and lead a multi-disciplinary team.

Recent advances

It can be seen that the field of rehabilitation medicine is wide. In the last decade there have been considerable advances on several fronts, especially in theory, therapeutics and organisation. We have selected some topics which may be of interest to the reader.

INFRASTRUCTURE

With the appointment of a sixth chair in rehabilitation medicine, the academic base of the specialty is expanding rapidly in the UK. A foundation for research has been laid down which is leading to knowledge-based clinical practice. This is timely, given the long overdue need for a thorough understanding of the processes whereby functional recovery occurs, and for controlled studies to evaluate the effectiveness of an enlarging range of therapies which are often costly to the National Health Service (NHS). Disabled people have long complained that attitudes to disability are poor within the NHS. It has been suggested that relevant training be incorporated into the undergraduate medical curriculum; the academic infrastructure is now being assembled to make this possible.

INTERNATIONAL CLASSIFICATION OF IMPAIRMENT, DISABILITY AND HANDICAP

The theoretical basis of the specialty has been strengthened by the construction of an international classification of impairment, disability and handicap (ICIDH) within which future advances can be developed.² Impairment is abnormality of anatomical structure or physiological/psychological function (eg, hemiplegia following stroke); this is the main focus of conventional medicine. Disability is restriction of ability to perform a normal function, consequent upon the impairment (eg, difficulty walking). Handicap is the resulting disadvantage experienced by the individual (eg, unable to continue employment); it is with handicap that patients suffering from chronic conditions are often most concerned. The ICIDH framework is beginning to influence clinical thought, since it classifies impairments, disabilities and handicaps in a systematic fashion which allows the practical implications of disease to be studied in a hierarchical manner within individual patients and at institutional or population levels. It is also contributing to evaluation of therapies by focussing more clearly upon the dimensions of outcome where putative improvement is to be expected.

MEASURING DISABILITY AND HANDICAP

The theoretical ICIDH framework is being applied to the real world by quantitative measures of disability and handicap. Since rehabilitation must be purchased within the NHS internal market, it is important to establish that disabled people get what they need and purchasers get value for money. Quantitative handicap and disability instruments offer the prospect of relevant functional measures to determine case-mix, define targets and assess performance. However, development of these instruments has proved to be complex: they must be scientifically valid and must offer satisfactory reproducibility between observers, while remaining sufficiently easy to use that they do not dissipate the energies of rehabilitation staff.

The Barthel score is well established as a disability measure.³ It is routinely employed by many clinicians to monitor the progress of rehabilitation and to screen for loss of independence after discharge from active therapy. However, the Barthel score is relatively insensitive to change and suffers a considerable ceiling effect – patients with maximum scores may still have considerable outstanding needs. An alternative to the Barthel score is the Functional Independence Measure (FIM), which seeks to generate a profile of disability from items relating to self-care, sphincter control, mobility, communication, and cognition.⁴ Although FIM is already gaining clinical popularity, its validation continues, particularly in specific disease categories such as head injury and multiple sclerosis. A subject of current interest is the combination of the ordinal data from each of the FIM items into linear indices describing the overall disability of a patient. Rasch analysis suggests that a single FIM-derived index would mix apples and oranges, but that the FIM profile may reasonably be reduced to two indices reflecting cognitive and motor function.⁵

Measurement of handicap is proving even more difficult than measurement of disability. Handicap is defined in six dimensions: orientation, physical independence, mobility, occupation, social integration and economic self-sufficiency.² The London Handicap scale has been proposed, which contains six questions covering the dimensions of handicap.⁶ Responses are given weightings which were derived from the opinions of a general population sample using a market research technique. When applied to a group of patients, this permits calculation of a mean handicap score which may be useful for comparison with another patient group in circumstances such as a clinical trial. However, the scale cannot be used to monitor directly changes in the degree of handicap experienced by a single patient, since this requires knowledge of the opinions of that individual, which may differ from those of the calibration sample of normal subjects. The London Handicap scale is undergoing validation, but has not yet entered general use. An alternative approach to measuring handicap, particularly after stroke, is being developed at Leeds University.

Quantitative measures of disability and handicap

- Barthel score (disability)
- Functional Independence Measure (disability)
- London Handicap scale

Box 4

BASIC AND APPLIED PATHOPHYSIOLOGY

At the impairment level, greater understanding has been gained of the pathophysiology underlying common impairments. For example, appreciation of the biomechanics and pathophysiology of gait has led to application of functional electrical stimulation for restoration of walking in selected paraplegic and hemiplegic patients. Although it has been shown to be an acceptable assistive technique for hemiplegic patients in the home environment,⁷ relatively few paraplegic patients use it regularly to generate purposeful walking, for reasons which should perhaps be clarified. There is a need to define the situations in which it is likely to be most effective, particularly comparing use as a long-term orthosis with transient application as a therapeutic tool.

APPLICATION OF TECHNOLOGY TO REDUCE DISABILITY

Technology has also made inroads at the disability level. This is well seen in prosthetics, where new materials and microelectronics offer significant contributions. Carbon fibre composite allows construction of lighter prostheses. Using a microprocessor which learns the characteristics of an amputee's gait, the 'intelligent prosthesis' can adjust its pneumatic swing phase control in response to changes in walking speed. Microelectronics have also expanded the potential of assistive devices such as communication aids and environmental controls, but this potential is not always exploited well in the UK due to lack of a consistent prescription policy. Assessment should ideally be made by consultants in rehabilitation medicine with specific training in assistive devices, who can place technology such as environmental controls in the wider context of the disabled person's overall needs. There is much more technology still waiting to be explored, but pressure for these developments is not as great in Britain as in the US. This may reflect differences between the civil rights of disabled people in these two countries, though there is also a healthy scepticism in the UK concerning elaborate technology as a substitute for down-to-earth interventions.

Current pre-occupations

EPIDEMIOLOGY

Most assessments of health needs to date have focussed upon disease; correspondingly, prognosis has largely been expressed in terms of mortality. Rehabilitation medicine concentrates on the implications of disease, and therefore new epidemiological studies are being conducted to define the extent of unmet need in the population. These look beyond diagnostic categories to establish the prevalence of associated impairment, disability and handicap. Examples include the prevalence of neurological deficit following stroke (A Tennant, paper submitted for publication), cognitive impairment due to multiple sclerosis⁸ and psychosocial sequelae of head injury.⁹ A sound appreciation of local need (and resources) is a prerequisite for planning appropriate rehabilitation.

CENTRAL NERVOUS SYSTEM RECOVERY

The patterns of recovery from neurological disease must be understood if rehabilitation strategies are to be planned rationally. The Copenhagen Stroke study is an example of contemporary prospective surveys employing impairment and disability measures to document the pattern of recovery.¹⁰ This reports that early improvement in feeding and grooming (which reflect combined function of both upper limbs) had reached a plateau within three weeks of stroke for 80% of sampled patients. There is also an interest in the longer term evolution of recovery from neurological insult: evidence is emerging of sustained improvement for three or more years after head injury.¹¹

As well as delineating the pattern of recovery from disease, there is also considerable interest in identifying factors which naturally influence recovery. Clinicians have long been aware that social considerations play a part in the evolution of many conditions; with reliable measures of disability and the means to quantify social factors it is becoming possible to establish the scale of social influences. A small longitudinal study of stroke patients has confirmed the importance of social support.¹² On average, a subgroup of patients with low social support actually lost some of the functional recovery which they had made in the first month. This effect seems to apply particularly to patients with relatively mild stroke; it may reflect reduced professional contact such as outpatient physiotherapy which might otherwise have provided coincidental social contact to compensate for lack of friends or family. In contrast, high social support is so strongly associated with good recovery in patients with moderate or severe stroke that the high support subgroup exceeded the functional independence of many mild stroke patients, whereas patients with moderate or low support had average

functional scores incompatible with day-to-day independence. If effects like this are confirmed in larger studies and other diseases, then allowance for social factors may compensate for some of the 'spontaneous' variation in recovery which has reduced the statistical power of much research in rehabilitation. At the clinical level, a formal quantitative assessment of social factors may contribute to management of individual cases.

UNDERSTANDING THE MECHANISMS OF HANDICAP

From the foregoing, it is clear that social factors can influence recovery. Even for a given degree of functional recovery, circumstances may also govern the disadvantage experienced by a patient. Expressed in ICIDH terms, circumstances modulate the impact of disability upon handicap. The emergence of quantitative measures of disability and handicap offers the possibility of testing the validity of the ICIDH conceptual framework by examining the extent to which circumstances account for the relationship between indices of disability and handicap. This work is in its infancy, but there is already quantitative evidence that the degree of mobility handicap experienced by individuals with walking disability is modulated by occupational demands.¹³

NEW METHODS OF PATIENT ASSESSMENT

As impairments and their functional implications are better understood, there is a drive towards more appropriate means of assessing patients. The emphasis continues to be upon clinical measures of which a wide range is under development.¹⁴ Although many of these assessments have the advantage of operating reliably without elaborate equipment, they may sacrifice sensitivity in order to define suitably robust clinical categories. For some impairments, there remains a need for measures which can offer higher resolution by resort to instrumentation, particularly for research purposes. An example is peak velocity of reaching as an index of upper limb performance in hemiplegia.¹⁵ Instrumentation is also playing an increasing role in assessments of work capacity, which are gaining popularity in the US, but are poorly developed in the UK.

EFFICACY OF REHABILITATION

Progress in the development of patient assessments is fostering a spirit of enquiry into the efficacy of existing rehabilitation methods. Of course, this is not entirely new: a selection of early clinical trials in stroke rehabilitation has recently been reviewed.¹⁶ Meta-analysis suggested that the average patient who received a programme of stroke rehabilitation performed significantly better than 65% of patients in comparison groups. However, the review highlighted several weaknesses of earlier studies which contemporary trials may be able to overcome, such as lack of information about stroke severity and use of non-standardised outcome measures. The current enthusiasm for testing the efficacy of rehabilitation is fuelled by the prospect of accurate case-mix identification and relevant outcome measures in terms of disability and handicap.

Contemporary rehabilitation trials are addressing two broad questions: 'What is the role of specialised rehabilitation units/programmes?' and 'Do individual therapy techniques work?'. Comparison continues between stroke management in general medical wards and dedicated stroke rehabilitation units; there is evidence that the latter may achieve greater functional independence and more rapid discharge, especially for patients with strokes of intermediate severity.¹⁷ In such trials, the rehabilitation component may be difficult to distinguish from the acute medical care, though this partially reflects the proper integration of the two. The impact of rehabilitation techniques is more clearly seen following interval re-admission for booster therapy. For example, a significant improvement in functional performance of head-injured patients has been retrospectively demonstrated following inpatient rehabilitation one year or more after injury.¹⁸ Such retrospective evidence is now stimulating prospective trials of rehabilitation packages. A logical extension of examining the efficacy of rehabilitation packages is attempting to identify the individuals most likely to benefit from them. Considerable effort is being devoted to predicting outcome from stroke by quantitative clinical assessments and physiological measurements such as somatosensory evoked potentials.¹⁹ However, predicting outcome is not the same as identifying individual patients whose recoveries are most likely to be enhanced by rehabilitation techniques. In this regard, disability measures may be helpful, since an association has been demonstrated between the initial FIM scores of stroke patients beginning rehabilitation and their subsequent functional improvement – patients near the centre of the functional spectrum on admission tend to show greatest improvement.²⁰ Evidence of this nature raises the possibility of channelling patients towards different rehabilitation packages

according to an initial functional assessment. Formal trials of such a strategy are awaited.

The second question being asked of existing rehabilitation methods is 'Do individual therapy techniques work?'. Several therapeutic modalities have come under scrutiny, of which physiotherapy is an example. Trials range from direct examination of the impairment under treatment (such as measurement of spasticity by isokinetic dynamometer²¹) to more functional outcome measures (such as speed of walking²²). Measurable responses to therapy have been reported, but it is being recognised that the nature and quantity of therapy input must be considered before final conclusions can be drawn. Evidence is already emerging of dose-response relationships for therapy to the arm²³ and leg.²⁴

NEW TREATMENTS

While existing treatment comes under scrutiny, new therapeutic avenues are also being explored. Dissatisfaction with the limitations and sedative effects of conventional systemic anti-spastic medication is generating interest in more focussed therapy. Intrathecal delivery of baclofen by an implanted pump has been shown to be a feasible alternative to oral therapy in patients with intractable lower limb spasticity.²⁵ Even this regional treatment may be too diffuse for patients who rely upon extensor tone for walking or transfers, but are troubled by adductor or hamstring spasticity. In these cases, and in patients with focal upper limb spasticity, there is a resurgence of interest in phenol nerve blocks.²⁶ Alternatively, local treatment of individual spastic muscles with intramuscular Botulinum toxin may avoid the risk of sensory disturbance.²⁷ Although Botulinum toxin is already being used against spasticity on an unlicensed basis, its expense dictates a need for formal closed trials of its efficacy in defined patient groups. Less expensive local therapies aim to modify spasticity by exploiting the influence of cutaneous afferents upon segmental reflex circuitry: transcutaneous electrical nerve stimulation has been shown to reduce clinical estimates of spasticity²⁸ and a pilot study suggests that topical anaesthesia may relax late contractures.²⁹

At a functional level, electrical stimulation is being explored as a means to augment re-learning of useful limb movements. As noted earlier, functional electrical stimulation is already established as an orthotic technique to assist ambulation; now its therapeutic potential is receiving greater attention. This has been demonstrated in affected upper limbs of stroke patients using pre-programmed stimulation³⁰ and stimulation triggered by the patient's own electromyographic activity.³¹

In the psychological domain, there is comparable interest in new therapies. Particularly heated discussion is surrounding the development of cognitive remediation techniques for head-injured patients.³² These are still in evolution, which has led to the criticism that they do not have a coherent theoretical foundation. Cognitive remediation is expensive and there is a need for more evidence that it is effective.

NEW METHODS OF SERVICE DELIVERY

With its emphasis on enhancing disabled people's roles in the community, rehabilitation has seen opportunities for new methods of delivering care which bridge the gap between hospital and community. As the unaddressed needs of head-injured people become apparent, a pilot study has demonstrated the feasibility of prospectively targeting patients likely to require specialist assistance, using a register established in the regional neurosurgical centre.³³ Patients requiring neurosurgical admission for more than 24 hours were offered domiciliary assessment by a community occupational therapist, who was then in a position to intervene directly or involve other agencies. This feasibility study has contributed to a Department of Health initiative setting up a number of Model Head Injury Teams throughout the UK in order to determine effective methods for a national head injury rehabilitation service. These teams are currently active and due to report towards the end of the decade.

Another recent innovation in delivery of care to head-injured patients has been the employment of case managers. Based on experience in the US and in elderly patients in Britain, case managers have been engaged in sporadic instances over recent years with the aim of coordinating the various professional services which may be available to their clients. A prospective controlled trial of case management in severe head injury has now been reported.³⁴ This confirmed that case management for two years after injury may increase the numbers of contacts with sources of professional help. However, total contact time for managed cases was no greater than in the control group. Most importantly, measures of patients' residual physical, psychological and social function up to two years after injury did not show any significant benefit of case management. The authors of this

study suggest that the lack of measurable benefit may be related to the inability of case managers to increase the volume of rehabilitation available, because of limited availability. That argument raises a profounder issue, since it implies that all patients are receiving insufficient rehabilitation. Case management is by no means quashed by this study: a variety of other models might yet be considered, particularly later intervention. Nonetheless, this trial stands as a good example of the objective assessment which should accompany all therapeutic interventions.

The above service examples are disease-based. It was noted earlier that rehabilitation medicine also looks beyond disease categories, with particular concern for subgroups of the disabled population whose needs are more related to their circumstances than to their diagnosis. These are exemplified by physically handicapped young adults, who experience considerable life changes at precisely the time that paediatric services must relinquish them, yet for whom there is little support in the adult healthcare system. New services are being introduced which specifically target these individuals.³⁵ These are multi-disciplinary in their make-up and aim to address the full breadth of clients' needs, including medical problems, independent living, occupation and personal issues (especially relations with parents, social integration, and sexuality). A significant element of their approach involves referral to other medical specialties and facilitating access to a variety of other agencies.

What does rehabilitation offer other specialists?

In districts where rehabilitation is offered as a medical specialty, a multi-disciplinary infrastructure is established which is geared to reducing handicap from any chronic condition, especially where psychosocial factors are significant. Direct-referral clinics can offer general practitioners a fresh view of patients with disabilities, and structured access to a wide range of services. For clinicians in acute hospital specialties such as general medicine, neurology, neurosurgery and orthopaedics, rehabilitation may maximise the results of their interventions in a wide range of conditions. Although it would be wholly inappropriate to regard the specialty as a 'dumping ground' for 'bed-blocking' patients, timely rehabilitation may free scarce acute hospital beds and hasten appropriate discharge.

The future – where are advances required?

The theoretical basis of rehabilitation needs further development. This applies particularly to the processes which determine the degree of disability resulting from impairments, and to the mechanisms of therapies which seek to reduce disability. What determines the use which a patient can make of a paretic limb? How does the patient circumvent impairment? Ideally, we require a coherent theory which can bridge the gap between the conventional impairment level and the more functional disability and handicap levels to provide a rational basis for developing and testing interventions at all levels. One possible source of such a theory is the emerging field of learning science. Empirically, it seems sensible to postulate that a process of learning is involved in the adjustments which an individual makes in response to changes in physical or psychological state due to disease (translation of impairment into disability). In patients with established disability, learning may also be involved in the adjustments required by a change in circumstance such as leaving school (translation of disability into handicap). Many existing interventions seek (implicitly) to educate the patient. Perhaps education can even influence impairments themselves such as perceptual disorder or spasticity. These considerations suggest that learning should be high on the agenda for future rehabilitation research. Unfortunately, many of the sporadic attempts which have previously been made to introduce learning concepts into rehabilitation practice have been based upon older theory and assumed a normal learning process even in the presence of neurological disease.

If practitioners of rehabilitation medicine are to harness the learning potential of our patients, we must be conversant with contemporary learning theory and contribute to its development. In the field of motor learning particularly, no single theory currently enjoys universal acceptance, but the 'ecological' approach is particularly attractive for rehabilitation, since it views the learning process as an exploration of the perceptual-motor workspace.³⁶ This approach lends itself to the integration of motor, perceptual and cognitive factors which we know to be intertwined in clinical practice. It also has the potential for practical application, for example through new biofeedback paradigms.³⁷ Before we can test and hopefully exploit ecological theory, three hurdles must be passed. Firstly, the theory of normal learning is still rudimentary and requires further development. Secondly, we cannot assume that normal learning theory applies to patients with

neurological disease – in fact, it seems likely that it does not. Thirdly, the ecological theory draws upon concepts which some clinicians may find too abstract and mathematical: to be clinically acceptable, theory must generate practical guidelines for intervention which can be applied to the demonstrable benefit of the patient.

Rehabilitation medicine shares the inevitable limitation of resources which is common to all specialties. Before greater resources can be claimed, valid means of quantifying the benefits of rehabilitation are required. This is complicated by the fact that health gains may be long term, may cross hospital/community or health/social service boundaries and may be manifest in subtle, non-economic terms such as quality of life for the patients themselves and their carers. Nonetheless, we must standardise objective patient assessments and functional measures to define our performance more accurately in terms of case-mix and functional outcomes. A useful approach may be translation of potential health gains into standard targets for rehabilitation which could be built into purchaser-provider contracts. Practical targets have already been suggested which are amenable to audit.³⁸ These would cover problems such as pressure sores, incontinence, contractures, fractures due to falls, communication, behaviour disturbance and sleep interruption for carers. Extending into the more subtle domain of life quality, there is a need to establish that valid health gain criteria include personal autonomy, independent housing and better employment, education or occupation of time. If measures of health gain relate to patients' realistic aspirations, they stand a better chance of being widely accepted and will be seen as proper indicators of good medical intervention. Adoption of such measures and targets could then permit the likely effects of enhanced rehabilitation effort to be studied and business plans drawn up to propose increased funding if this is appropriate.

No matter how clearly the potential health gains from rehabilitation may be demonstrated or how eloquently the business case for expansion be presented, rehabilitation medicine will doubtless always face some of the resource limitation which is inevitable in healthcare. Pending radical advances such as new medications to enhance recovery from neurological lesions, we must examine our current techniques to discern scope for improved efficiency. At the organisational level, health gains may be expected from more cohesive management and elimination of boundary problems. The possibility has been discussed above of stratifying patients upon the basis of initial assessment and channelling them towards different rehabilitation packages. For example, stroke patients with high initial FIM scores might be considered for earlier outpatient therapy.²⁰ Since the mainstay of rehabilitation is labour-intensive therapy, the use of automated techniques to supplement conventional therapy should be developed. Micro-computers are already employed in treatment of perceptual neglect.³⁹ In physical therapy, a parallel role for robots might be explored. Progress in this field will require much work on the patient-machine interface: despite the considerable prowess of industrial robots, their techniques cannot easily be adapted to the pliable human form with its many degrees of freedom. Even when robots can bridge the interface, they will never replace the personal dimension of patient treatment which is so well developed in rehabilitation medicine.

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Medical Anniversary

JOHN FARQUHAR FULTON, 1 NOVEMBER 1899

John Farquhar Fulton (1899-1960) was born at St Paul, Minnesota, USA, the son of an ophthalmologist. He was educated at Harvard, came to Magdalen College Oxford as a Rhodes Scholar and, under the influence of Sherrington, became a neurophysiologist. He graduated MD from Harvard (1927) and became FRCP (1953). He became professor of physiology, and later professor of the history of medicine, at Yale. He will also be remembered for his outstanding biography of Harvey Cushing. - D Geraint James

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