

PHYSICAL MEDICINE AND REHABILITATION

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FOREWORD BY THE EDITOR

This Textbook has been written primarily from the viewpoint of the clinician who wishes to employ physical methods in diagnosis and treatment, and as such it makes no attempt to describe the minutiae of technique thereby employed. It is felt by the Editor that Physical Medicine has now an important part to play in every branch of Medical Science and that all clinicians of the future will be expected to know the basic principles of this subject as it affects their clinical speciality. The restoration of function is the aim of rehabilitation and the term "Physical Medicine" covers the methods employed in this process.

It will be observed that the basic sciences are first studied in some detail in this book and that the individual contributions on the clinical application are thereby rendered rather shorter.

An attempt has been made to obtain contributions from a wide variety of the leading exponents of this speciality on both sides of the Atlantic and where a number of contributors take part in such a work it is impossible to prevent some degree of inbalance occurring. While the Editor has endeavoured to keep this to the bare minimum, he has not thought it proper to prevent the liberty of individual expression which marks the original work of each chapter. On the other hand, as far as possible, repetition of the same viewpoint by different authors has been avoided.

I wish to thank a great number of friends who have helped to bring this work to fruition. In particular, Group Captain C. J. S. O'Malley C.B.E., M.B. B.S., who has acted as Deputy Editor to me throughout and has taken endless trouble to correlate the various contributions. I also wish to thank R. T. Hewitt O.B.E., M.A., the Secretary of the Royal Society of Medicine, for his help in the use of correct English in my own chapters. A great burden of work has been carried out by my secretarial staff, in particular Miss M. Lock, without whose help it would have been quite impossible to have the various manuscripts frequently re-typed and controlled during their travels around the world to the printers in Holland and to authors in England and America.

BASIL KIERNANDER.

INTRODUCTION

THE MEANING AND SCOPE OF PHYSICAL MEDICINE

I. Attempts at defining "Physical Medicine" cannot be said to have met with much success. Bach's definition: "the employment of . . . light, heat, cold, water, electricity, massage, manipulation, exercises and mechanical devices . . . in the diagnosis and treatment of disease" is scarcely so much a definition as a catalogue of agents which the Physical Medicine Specialist employs; and it omits any reference to the important contribution which the exponent of this branch of Medicine makes towards "keeping the fit fit and making the near to fit quite fit", i.e., "positive health". Bach gets nearer to a definition when he proceeds to say that Physical Medicine "is the application of the physician's art and his particular knowledge of biophysics to the investigation and treatment of his patient and to the maintenance of health and the prevention of disease".

The overlap of Physical Medicine with other branches of Medicine is so considerable that there are those who would question if it should be regarded as a specialty. But this view can only be taken by those who pay little heed to the evolution of Physical Medicine as it exists today and no heed at all to its great value when viewed from the angle of pragmatism.

II. The limits of this article do not make possible a recital of the history of Physical Medicine. The sun, the air, water, exercises and manipulation have been Medicine's handmaidens since earliest times. Each one of these has been vaunted as the panacea for man's ills — or their prevention — and this faith, originally primitive, still exists under the guise of various systems of therapy. Fifty years ago, or so, the large teaching hospitals in the country, — institutions which have mirrored the progress of Medicine with remarkable clarity, — began to set up "special departments" in which physical methods in diagnosis and treatment were employed. It is noteworthy that diagnosis was as early a feature as treatment in the beginnings of Physical medicine, because there are critics who express doubt as to whether the field of Physical Medicine covers anything more than treatment. In the early "Electrical Departments", for example, the discoveries of Erb and Duchenne were followed and developed and invaluable help in differential diagnosis resulted. As the various forms of "ray therapy" were introduced these were grafted upon the "electrical" service. Similarly, depart-

ments were set up for massage and gymnastics, generally under the charge of the orthopaedic surgeon.

Speaking generally, these "departments" were stowed away in attics and odd corners and, more often than not, it was the flotsam and jetsam of his medical and surgical colleagues with which the chief had to deal. Water, as a therapeutic agent, was in the hands of the "balneologist" at the Spas, air and sunlight were restricted to the tuberculous patient — far too restricted, as we now realise. X-rays had, both for diagnosis and for treatment, grown so rapidly in demand that they soon became a specialty in themselves.

III. It was by a fusion of these early departments some two decades ago, that the first integration took place leading to the special hospital service which we now know as "Physical Medicine". Then came the powerful addition of a relatively new element — the whole nexus of diagnostic and therapeutic measures, both preventive and curative, resulting from experience gained in "physical training" during the war. So short was fit man-power in the early stages of the conflict that those responsible for the fighting personnel decided to give serious attention to the large number of unfit men who had been recruited. They sought the help of key medical men in an effort to up-grade a large proportion of these unfit recruits. This wisdom was rewarded to a quite surprising degree. The experience thus gained was much too good to end with the war; it was carried over into the peace and soon became a fundamental feature in the new concept of Physical Medicine.

IV. Concurrently with this development on the physical training side another advance was taking place — the Chartered Society of Physiotherapists was becoming a corps of highly trained women and men available for skilled service in the Physical Medicine field.

The union of these two large tributaries, as it were — of a congerie of technological procedures on the one hand and of the much wider application of physical training on the other — resulted in the river which came to be called Physical Medicine. The union was not easily effected; individual claims asserted themselves; there was a tendency for the followers of one cult to disparage the work of the other; there was talk of the "sergeant major" and of the "gadget monger". But common sense and a common purpose — the patient, actual or potential, — brought about the necessary adjustments and the formation of the British Association of Physical Medicine in 1943 went far to effect the desirable equilibrium. Both

sections settled to a loyal pooling of their contributions and the joint stream became strong and therefore effective.

V. The scope embraced by the combined efforts of the two sections as outlined above is very wide. It stretches from the fundamental efforts to secure proper poise and posture and stance and gait and breathing at one extreme to the correction of deformities, help for the paralytic, and the management of convalescence at the other.

VI. Physical Medicine plays a major part in the management of the rheumatic patient. To suggest that there is any room for conflict between those whose main interest in the Rheumatic Diseases lies in their etiology and natural history and those who approach the same problem from the therapeutic angle of Physical Medicine indicates lack of clear thinking. The difficulty is imaginary and is resolved at once if the dictum of Trousseau be kept well in mind:

"Le malade, toujours le malade".

VII. Concurrently with the growth of interest in Physical Medicine the concept of "Rehabilitation" has acquired a new orientation. So much so that there is perhaps a danger lest it be thought that it is the business of Physical Medicine alone to restore a diseased or a damaged man to full function in his particular job, or, if residual disability makes this impossible, then to fit him for some other job which is of use to society and to himself. This is, of course, the purpose of Medicine in general and applies equally to disease as to injury, to dysfunction of the heart or kidney or lung as to paralysis or deformity.

All the same, a new significance does attach to the concept as the result of a more hopeful and more helpful spirit shown by modern Medicine towards those who have been handicapped by disease or injury, this spirit being backed by new techniques, new instruments and new efforts, begun earlier and persisted in longer. It is in the exploitation of this new spirit and of those new methods that Physical Medicine so amply justifies itself.

VIII. It is to be conceded that the demands made upon the Physical Medicine Specialist are very great. That he must be a clinician first and foremost follows clearly from the principles already laid down. In his approach to, and handling of, his patient he must have the whole man in mind and not merely the part of him for which his help is particularly required. He must win his patient's confidence

early and must keep it throughout, for he will be more dependent upon his patient's co-operation in the carrying out of treatment which will often be tedious and not infrequently discouraging in the patient's eyes, than is the case in most of the other branches of Medicine. Indeed, there is no branch in which success turns so much upon the power of the physician to infuse the patient with his own personality.

But that there are men who combine these essentials in their make-up and in their training becomes more and more obvious as the development of the speciality proceeds. And since it is inevitable that their own intrinsic interest, regarded technologically, will be greater in one direction than in another in this so composite a field these men will, when chiefs of departments of Physical Medicine, choose as their assistants men who favour other techniques than their own, so that the team may be as representative as possible of the whole diagnostic and therapeutic problem that faces them.

That such men should possess what is termed a "higher degree", both to signalise their status and to give them the necessary prestige, goes without saying. That they should rank on an equality with the physicians and surgeons attached to the staff of the hospitals they serve, that they should teach and that they should, whenever practicable, have both out and in-patients under their special care, is equally self-evident. Only in this way does the Physical Medicine Department of a hospital live up to the acknowledged importance of the subject for which it is established.

IX. The articles in this book show very clearly how wide is the scope of Physical Medicine on the one hand and how thoroughly its exponent must prepare himself for its due exploitation on the other. The Editor has been wise in resisting the temptation to aim at uniformity of opinion in respect of the various sections though this has meant some repetition here and there. In the present cultivation of such a new field such dictation would have done a disservice to a specialty whose actual value is already great and whose potential value is incalculable.

HORDER

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CHAPTER I

THE FUNCTIONAL ANATOMY OF THE LOCOMOTOR SYSTEM

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INTRODUCTION

In this chapter, the structure and function of the various components of the locomotor system will be discussed in some detail, so as to provide a basis for the understanding of certain methods of diagnosis and treatment by physical methods.

A systematic study will be made of the synovial joints, voluntary muscles and the central and peripheral nervous systems. In addition, degeneration and regeneration in the nervous system are dealt with in outline. To cover this field in a relatively short space, a certain level of anatomical knowledge has been assumed and to avoid overloading the text with references, a bibliography is appended which will provide the reader with fuller details of the subjects discussed.

JOINTS

In this section, only the freely movable synovial or diarthrodial joints will be considered. Essentially, these joints serve the purpose of movement and weight-bearing and thus have to combine mobility with strength. They include all the joints of the limbs with the exception of the inferior tibio-fibular syndesmosis and the pubic symphysis.

A diarthrodial joint may conveniently be considered as tissue space containing a minute quantity of synovial fluid. It is bounded by the cartilage covering the articulating surfaces and a modified connective tissue composing the tough fibrous capsule and the delicate synovial membrane.

THE ARTICULAR SURFACES

The articular ends of the bones are expanded. Many explanations have been suggested for this expansion; for example, to allow more precision of movement, to lessen the chances of dislocation, to diffuse any shocks transmitted to the bone and to afford increased area for the attachment of muscles which, in the case of limbs, are often attached adjacent to the articular surfaces. The shape and size of the articular surfaces often depict the axes and range of movement allowed at the joint. Where movement is limited, the reciprocal surfaces are approximately equal in size, but where movement is free, they show considerable differences. In the shoulder and the hip joints, the glenoid cavity and acetabulum are deepened by a fibro-cartilaginous lip or labrum.

The articular surfaces of the bones are covered with hyaline cartilage, although those joints between bones developed in membrane, such as the temporo-mandibular joint, are covered by dense fibro-cartilage. The cartilage has a bluish ground-glass appearance and is apparently smooth, although microscopically it is covered with minute projections, possibly indicating the effect of 'wear and tear'. Articular cartilage is relatively acellular and those cells which are present are situated in the deeper layers. It is also nerveless and bloodless and can, therefore, suffer pressure without pain or swelling. The deepest part of the cartilage is calcified and is firmly attached to the underlying layer of compact bone — the articular lamella. Permeating the cartilage, there are coarse and fine collagenous fibres. The thick fibres are so disposed as to take and balance the tension set up by deformation consequent on pressure. They pass obliquely from the free surface towards the bone.

Replacement for 'wear and tear' is effected by the amitotic division of the more deeply placed cells and by an increase in the intercellular matrix. However, hyaline cartilage has little intrinsic power of regeneration and, if damaged, it is usually replaced by fibrous tissue or fibro-cartilage. With movement, the cartilage becomes thicker due to an increase in the amount of ground substance. In weight-bearing, the articular cartilage becomes compressed to return to its original thickness when the weight is relieved. On the other hand, it atrophies with fibrous replacement when a joint is immobilised, and the cartilage thins irreversibly with constant pressure.

As the cartilage is avascular, its cells obtain most of their nourishment from the synovial fluid. At the periphery, this may be supplemented by substances diffusing from neighbouring blood vessels. It has been suggested that this explains the degeneration of the central area of cartilage in osteo-arthritis, whereas there is proliferation of it at the periphery. The cartilage on the centre of the head of the femur has an added supply of nourishment from the blood vessels within the ligamentum teres — a triangular structure of little ligamentous value with its base attached to the acetabulum and its apex to a pit on the head of the femur. These blood vessels, besides supplying the articular cartilage, also form an important source of supply to the rest of the head of the femur.

Articular cartilage has a certain degree of resilience and, because of this, it is able to withstand intermittent pressure and to absorb shocks, thus protecting the bone. The relative smoothness of the