CONTRIBUTIONS TO
MECHANICO-THERAPEUTICS AND ORTHOPEDICS
EDITED BY L. WISCHNEWETZKY, M.D.

VOL. I. NO. 1.

THE

Mechanico-Therapeutic Institute

BY

DR. GUSTAF ZANDER
IN STOCKHOLM

PUBLISHED BY THE
MECHANICO-THERAPEUTIC AND ORTHOPEDIC ZANDER INSTITUTE
246 FIFTH AVE., NEW YORK CITY

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PREFACE.

THE following pages form the introductory issue of a series of Contributions to Mechanico-Therapeutics and Orthopedics which will be published from time to time with the co-operation of Dr. Zander in Stockholm, Drs. Nebel and Nönchen in Frankfort-on-the-Main, Dr. Schütz in Berlin, Dr. Heiligenthal in Baden-Baden, Dr. Hasebroek in Hamburg, and other pupils of Dr. Zander active as directors of similar institutes.

While the Contributions will contain chiefly the work of Dr. Zander and his pupils, it is proposed to open their pages to other competent contributors here and abroad. Thus there will be published writings of mechanico-therapeutists and orthopedists in Germany, Austria, England, Scandinavia, Switzerland, Russia, and France, with an occasional *résumé* of current literature of the subject and critical reviews of records of cases.

The present monograph has been chosen to serve as initial number, because it formulates with the author's peculiar lucidity the function of mechanico-therapeutics and the characteristics which distinguish Dr. Zander's method from all others.

This will be followed by Dr. Zander's description of apparatus, a work containing in compact form the

theory of movements from the stand-point of anatomy and physiology.

Succeeding numbers will contain several works by Dr. Nebel, viz., his contributions to the "Mechanical Treatment of Chorea," of "Muscular Rheumatism," and of "Disturbances of the Circulatory System," the latter monograph containing a criticism of Oertel's Dietetic Mechanical Treatment, better known as Mountain Climbing.

The publication of Dr. Nebel's more comprehensive work on "Mechanico-Therapeutics, including Massage, with especial reference to Dr. Zander's Mechanical Treatment," will follow at an early day.

Dr. Zander's very instructive monograph upon his treatment of Scoliosis[1] will be published, this part of the orthopedic treatment having come into the foreground since the completion of his apparatus for measurement of the trunk and transverse outline of the thorax, two apparatus which have rendered it possible, now for the first time, "to ascertain the form and carriage of the trunk with such ease as to admit of sufficiently frequent repetition, and with sufficient accuracy to demonstrate trustworthily, both the effect of different movements and the result of the treatment as a whole."

Guided by the data ascertained by these measurement apparatus, Dr. Zander has perfected several orthopedic apparatus, including those for lateral suspension, lateral pressure, thorax rotation; for exercise

[1] Om Den Habituela Scoliosens Behandling Medels Mekanisk Gymnastik af Dr. G. Zander, i Stockholm, Nord. med. arkiv band xxi., no. 22.

upon a slanting seat, by rising from recumbent positions; for counteractive pressure upon spinal curvatures while seated, etc.

The use of these specifically orthopedic apparatus *in conjunction with active and passive movements* appropriate to each individual case, has rendered the treatment of scoliosis according to Dr. Zander's method, scientific and in the highest degree effective.

In severe cases it is not possible to promise much improvement in regard to the basic malady, but its progress can be checked and life made more endurable for the patient. The *prevention* of severe cases rests very largely with the family physician, his detecting scoliosis in the earliest stages, and placing the patient under mechanical treatment in competent medical hands.[1]

As I write there appears the first number of a most welcome publication, the Journal of Orthopedic Surgery, including Curative Exercise and Massage (Zeitschrift für Orthopedische Chirurgie einschliesslich der Heilgymnastik und Massage), published with the cooperation of Professor Wolff and Dr. Beely, in Berlin; Professor Lorenz, in Vienna; Dr. Schulthess, in Zurich; Dr. Nebel, in Frankfort-on-the-Main; and edited by Dr. Hoffa, in Würzburg.

This journal embodies in literature the fact that the

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[1] "In view of the unspeakable difficulty involved and the limited efficiency of therapeutics in dealing with advanced curvatures, it is to be hoped that the unfortunate optimism with which physicians, as a rule, regard incipient curvatures of the spine, may yield, at last, to a more reasonable conception."—Lorenz, Pathologie und Therapie der seitlichen Rückgrat-verkrümmungen, Scoliosis, p. iv.

foremost orthopedists of Europe, of whatever school, perceive that for orthopedic work, supports, bandages, and plaster appliances are far from sufficient, and must be replaced or supplemented by curative exercise, which is indispensable for preventing atrophy (induced by that more primitive manner of treatment, hitherto usually carried on at the expense of the general health of the patient), and as subsequent treatment after surgical operations.

The publication of this periodical shows that in the consensus of the competent the three disciplines are inseparable which, together, form mechanico-therapeutics.

The Contributions enumerated will be issued in quick succession, and followed by others now in preparation. The publication of the first numbers has been delayed by the absorbing work of organizing the Institute and treating patients.

In founding the first Zander Institute in this country, it was no slight task to embody all the advantages attained during more than a quarter of a century by the institutes abroad, while excluding all that experience rejects. Such technical arrangements as provision for noiseless motion and concealment of all connections with the motor power required by the passive apparatus are important in the treatment of nervous and neurasthenic patients, who form a large contingent in the corresponding institutes abroad. The task has been accomplished, and the interest shown and efficient support afforded by the profession to the New York Institute during the first year of its activity, despite the absence of literature of the subject, have amply rewarded these labors and shown that there

was need felt of an Institute for scientific mechanico-therapeutics.[1]

Another difficulty was the absence of a scientific terminology[2] of mechanico-therapeutics in the English language. In this respect little progress has been made, the most copious literary productions having, with single exceptions, been those of rubbers, "masseurs," gymnasts, Swedish Doctors of Philosophy,

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[1] During the past winter an advertising pamphlet, illustrated with cuts of some machines, and of surgical appliances long the common property of the profession, was scattered far and wide by a "Mechanico-Therapeutic Institute," 422 Clermont Avenue, Brooklyn.

This advertisement led to inquiries by a few physicians and patients. A personal inspection showed that the place contains the few machines which figure under the name "Improved Movement Cure," in Fifty-ninth Street, in New York City, and in the advertisements of their "Originator," Dr. George B. Taylor.

It is scarcely necessary to state that the concern bears no resemblance to the Mechanico-Therapeutic and Orthopedic Zander Institute of New York City, of which it has appropriated a part of the name. To point out this treason on the part of his disciples in their eagerness to be mistaken for a Zander Institute, seems only just to the "Originator" of the "Improved Movement Cure." There is reason to believe that a complete Mechanico-Therapeutic and Orthopedic Zander Institute will be established in Brooklyn in the near future, under the direction of a responsible physician, without advertisement.

[2] This was keenly felt in the winter of 1889–1890, when, after spending some time in Zander Institutes in Germany, it was my good fortune to visit in Stockholm Dr. Zander, the father of scientific mechanical treatment, to work in his institute and look about among the institutes of more primitive type.

In revising MS. translations which I had previously made of his works, Dr. Zander experienced the same embarrassing lack of recognized English equivalents for Swedish and German terms.

lieutenants, and others distinguished for their lack of medical education.[1]

The literature now in existence in English embraces treatises upon "manual massage," "mechanical massage," gymnastics, physical culture, with dissertations, medical and otherwise, upon the "Philosophy of Movements," illustrated with cuts suggesting acrobatic feats for scoliotic patients! It embraces, in short, pretty much everything save a scientific discussion of mechanico-therapeutics.

The want of scientific terminology corresponds to the lack of scientific thinking upon the subject; to the failure to draw a sharp line between sport and quackery on the one hand, and mechanico-therapeutics on the other.

This confusion of ideas manifests itself in action in several important directions, as we shall see.

Mechanico-therapeutics embrace the treatment, by a properly qualified physician, of the sick (chiefly those suffering from chronic diseases), the deformed, the convalescent, the feeble, the aged, and persons needing to counteract the effects of sedentary occupations, by means of movements active and passive, mechanical operations, corrective pressure, and mas-

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[1] An amusing example of these is a Manual of Instruction for the Medical Profession in Swedish Movement and Massage, by Hartvig Nissen, a gymnast, self-styled "Professor."

It is characteristic that of five medical periodicals which seriously mentioned this book, not one commented upon the incongruity of a layman instructing physicians in the use of a therapeutic agent.

sage, *i.e.*, manipulations executed by the hand directly upon the skin. It is necessary to specify the sense in which the word massage is used, because it is applied indiscriminately even by medical writers.

How little the difference between sport and legitimate medical work is recognized, is shown by the incidental treatment of *scoliosis* in a Ladies' Athletic Club. Hapless scoliotics!

In view of the widespread and growing interest in sport, and the number of gymnasiums and athletic clubs in vogue, it is to be welcomed when a physician affords to the general exercising public that which has hitherto been accessible chiefly to collegians, *i.e.*, medical supervision so far as cycling, running, boxing, etc., can be said to be susceptible of medical supervision.

This is done, for instance, in Dr. Savage's well-arranged Physical Development Institute. By frequent examination Dr. Savage can determine which members of his Institute are unfit for gymnasium work, and by constant supervision he can reduce to a minimum, better than can be expected in an ordinary club, the danger constantly menacing from exercise prolonged in excess of strength, or from violent exertion.

Having a field of activity analogous to that which a number of physicians have found worthy of their best efforts, in connection with the colleges, why does Dr. Savage attempt to engraft treatment of patients upon his arrangements which are from the medical standpoint essentially for sport?

His prospectus shows that he recognizes the character of his Institute, to which he refers as a "first-class gymnasium," affording "boxing or fencing, bowling

or billiards, without the associations of a bar," and giving "opportunity to train for some athletic competition, and have a bath and 'rub down' after work," "a head-quarters for small clubs or individuals taking exercise in the park."

Yet Dr. Savage mixes sparring and fencing instruction in the same paragraph with "cases needing special treatment," and includes nearly all the indications for mechanical treatment in the following:

SOME DISEASES IMPROVED OR CURED BY EXERCISE.

Insomnia, nervousness, St. Vitus's dance, the various sorts of peripheral paralysis, penman's and pianist's cramps, distortions and deformities, and especially in curvatures of the spine and defects of carriage, affections of the heart and organs of respiration, chronic gastric and intestinal catarrh, habitual constipation, disturbances of the liver, chlorosis, anæmia, corpulency, gout, diabetes, etc., etc.

While it is undoubtedly true that improvement or cure may be obtained by means of exercise, the question remains, What form of exercise? What have patients suffering from these disorders to expect from an establishment adapted to sport? Why should the Development Institute undertake the treatment of "insomnia, nervousness, distortions and deformities?" Why "*especially* curvatures of the spine and defects of carriage, affections of the heart and organs of respiration?" On what basis can such cases be treated there? What measurements underlie the treatment of scoliosis?

In the treatment of the heart and organs of respiration, to which such critical attention has been given anew since Oertel's mountain-climbing forced the discussion of the subject, and which Dr. Savage "*espe-*

cially" "*improves or cures,*" what enables him to adapt each day's exertion to the strength of such patients, each movement to the requirements of the individual case, so that these sufferers, as well as the nervous and sleepless, may be daily refreshed, not wearied?

Here Dr. Savage ventures upon ground for which the Development Institute is not, and cannot be, adapted. For such persons no gymnasium is the proper place. They require an exactness of treatment an undeviating precision of observation from movement to movement, and from day to day, inconceivable in an institute the prime purpose of which is sport.

In short, persons suffering from the diseases which Dr. Savage enumerates, need *curative* exercise, which can be measured, graduated, individualized, and administered with an amplitude of resources for meeting varying conditions and recording changes, however slight, in the condition of the patient.

All these requirements can be met by mechanical treatment according to Dr. Zander, who has embodied in his method the result of thirty years of successful endeavor to solve these problems and comply with these demands, as is conceded by the first clinicians of the Germanic countries, and proved by the records of thousands of cardiac cases alone, treated in Sweden and in Germany.

The Development Institute, on the other hand, would seem especially fitted for healthy school-boys and students who have not yet entered upon the wear and tear of business or professional life, whose hours of work and recreation are regular and in wholesome proportion for physical and intellectual development.

By reason of the feverish excitement of American

life in the great cities, it is more than doubtful whether sport, as carried on either in a gymnasium or a development institute, can serve the purpose of dietetic exercise. For adults the calm exercise of the Mechanico-Therapeutic Zander Institutes will be found undoubtedly more appropriate and more beneficial. Experience points in this direction, since an increasing number of persons visit such institutes in Europe for dietetic treatment.

The fact being generally accepted and acted upon, that the exercise of collegians requires constant medical supervision, with frequent examination to detect weaklings and banish them from the field of sport, *the next step should be the appointment of school physicians to watch the development of the children*, not merely the hygienic condition of the school-houses but the actual physical status of the individual pupil.

If the children in school were subjected to constant, competent medical observation, it could no longer happen that those who are disposed to affections of the lungs, heart, spinal column, or nervous system, must either exercise with their sturdy classmates or not at all. For the feeble, the deformed, and those afflicted with the constitutional tendencies referred to, mechanical treatment under competent medical direction should replace common gymnastics; and the school physician would not merely pick out those unfit for ordinary exercise, but secure for them proper treatment. This presupposes, of course, an acquaintance with the indications, at least, for mechanical treatment. The need of such supervision is the more urgent, as neurasthenia and scoliosis among pupils are becoming characteristic attributes of school life.

The interest in physical culture in the general public manifests itself substantially, in gifts for gymnasiums for schools and colleges. It rests with us physicians to make it available in the manner most useful to the greatest number of children. To this end the demand for the appointment of competent school physicians is an important step.

If, as we have seen, it is necessary that a physician be placed in charge of the exercise of persons in good health, how much more urgent a need is the assumption by adequately qualified mechanico-therapeutists of the curative exercise, which in this country is now chiefly in the hands of rubbers, masseurs, masseuses, gymnasts, Swedish lieutenants, and other mechanical quacks, as surgery used to be left to the barber.

Thus for instance one component of mechanical treatment, massage, with which no competent mechanico-therapeutist would dispense; applying massage scientifically, equipped with knowledge of anatomy and pathology, the competent mechanico-therapeutist discriminates the physiological effect of each manipulation, and secures his results by means which he applies responsibly. But what is actually done today?

Of one hundred cases in which massage is applied in the ordinary way, it is safe to say that in two-thirds it does not correspond to the indications, but is merely rubbing; doing no good if, happily, it does no harm, and often wasting by delay the opportunity to accomplish cure or improvement by means of active and passive movements or orthopedic treatment.

For, as Dr. Zander long since pointed out, "it should be remembered that massage, which primarily under-

takes to free the tissues from swellings and infiltrations, and is therefore a cleansing process, cannot unaided restore an organ (muscle, joint, etc.) to a normal and vigorous state, but that for this purpose individualized active and passive movements are necessary. Massage without simultaneous or subsequent treatment of this kind is incomplete. It has, as I hear, been carried on by some persons for a number of years without accomplishing improvement for more than a passing interval. This is really a misuse of massage, but it is not always grounded in the ignorance of the masseur, but often in the indolence of the patients, who prefer to let another knead them, rather than take the trouble to make a few movements."

The responsibility for the patients' indolence frequently rests with the physician, who sees himself confronted by the alternative of prescribing massage, which, however ill administered, is, by comparison harmless, or of sending the patient to a common gymnasium for work often involving positive danger, or to a lay gymnast of the "manual" sort whose treatment is not subject to control.

The prime reason for the physician's action is probably more often his own lack of acquaintance with mechanico-therapeutics, and consequent underestimate of it and undiscriminating use of its components.

The medical schools have afforded no opportunity of acquaintance with mechanico-therapeutics, in the comprehensive sense of the term. Though the curriculum may include the subject, the lectures embrace a part only of mechanico-therapeutics, *i.e.*, orthopedics.

It is encouraging that three universities—Harvard, the Johns Hopkins, and the University of Pennsyl-

vania—propose to establish Mechanico-Therapeutic and Orthopedic Zander Institutes in connection with their medical schools.

A free department in the New York Institute will be established at the earliest possible moment, in order that this valuable therapeutic agent may be made accessible to persons of small means, thus also affording to members of the profession an opportunity of observation upon a large number of cases from hospitals and dispensaries. Ultimately this will naturally lead to the establishment of courses for physicians in mechanico-therapeutics (including massage) and orthopedics.

There are, of course, men who already justly recognize mechanico-therapeutics and see the present status in this country as it is.

Having acquainted himself with mechanical treatment according to Dr. Zander in the Institute in Baden-Baden, Dr. Weir Mitchell has recognized its importance; and the projected Institute in connection with the hospital of the University of Pennsylvania will doubtless have in him an effective co-worker. He long since embodied massage as a part of the well-known treatment which bears his name.

Dr. William Hunt, senior surgeon of the Pennsylvania Hospital, Philadelphia, after being a patient in the governmental Institute in Baden-Baden, published a descriptive article in which he warmly advocated mechanical treatment according to Dr. Zander, and stated that everything attempted in this country in the same field is crude in comparison with it.

In New York, Dr. Isaac Adler early included mechanical treatment among his therapeutic resources.

Thus he prescribed massage among the few who first recognized its utility. From personal experience we know that he years ago justly appreciated the governmental Zander Institute in Baden-Baden. From the earliest stages throughout the time of overcoming obstacles to its successful establishment, the New York Institute has found in Dr. Adler a most helpful and disinterested friend.

In the latest work on massage, Dr. Emil Kleen of Carlsbad mentions the reply of the gynecologist, Dr. Charles Carroll Lee, to a question as to the status of massage:

"In this country massage is still in an embryonic state."

We thought it had entered upon infancy, but we bow to the opinion of the gynecologist!

In default of opportunity for such instruction, as that already referred to, there is, however, within the profession a too general acceptance of the prevailing charlatanry as a normal condition. It is not assumed as a matter of course that a physician must devote years of study to the subject, as the surgeon, gynecologist, or other specialist is expected to do. Nor is it generally recognized in America, as has long been the case in Europe, that mechanico-therapeutics should be in the hands of the medical profession, and that the present relation of the profession to the charlatans in this domain is unique and absurd.[1]

A rubber, masseur, doctor of philosophy, gymnast,

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[1] Accustomed to the relation with a class of quacks, some physicians are cheerfully ready to suggest "appropriate" treatment in a given case to the mechanico-therapeutist, without having made the

or Swedish lieutenant, writes books of instruction, and trains aides for the profession ; applies without medical supervision a therapeutic agent of far-reaching and subtle power ; is recognized as lecturer in a medical school, or takes part in a conference on physical culture, not as a modest listener, but as the instructor of teachers and physicians, who would with prompt energy eject from their councils a quack manifesting like presumption in any other field of medicine.[1]

Masseurs and gymnasts of both sexes, if skilful and conscientious, may be useful under the same rigid disciplinary supervision by the mechanico-therapeutist which the surgeon bestows upon the trained nurse in the hospital. The competent physician employing them discriminates the cases in which they may work under his direction, from those requiring his own application. The therapeutic agent which they administer is too powerful and difficult of measurement to be entrusted to the undirected discretion of men and women ignorant of anatomy, physiology, and pathology, or handicapped by such half knowledge as is afforded by the Royal Central Institute in Stockholm, or promised by the prospectus of the Boston Normal School of Gymnastics, where the theory and practice of medical gymnastics are to be taught in one hundred and seventy hours by a doctor of philosophy![2]

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slightest study of the subject. There would be more excuse for their doing the same thing in any other field of medicine of which they have at least learned the indications in the medical schools.

[1] The Boston Physical Culture Conference, 1889, will be discussed in a paper prepared for the New York Physical Culture Conference organized by the New York Mechanico-Therapeutic Institute.

[2] It is to be hoped that this part of the programme may be

Analogous to the instruction in medical gymnastics proposed by the Boston school, is the fact that massage has been taught during several terms at a leading medical school in the metropolis of the United States, to masseurs and masseuses by an ignorant rubber, while carrying on his preliminary medical studies.

A very general failure to appreciate the scope and possibilities of massage can alone explain the employment by physicians of masseurs and masseuses equipped with "degrees" conferred by Osbaldiston and his peers; or the acceptance of the army of Swedes and others who print on their cards "scientific massage," "pupil of Dr. Metzger,"[1] etc.

Under these conditions it is not surprising that massage should be valued chiefly for its "psychical influence," though the constant use of this "winged word" betrays ignorance of the danger to hysterical

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promptly abandoned, and that the Boston school may abstain from adding to the quacks now extant teachers of medical gymnastics trained by a doctor of philosophy! Though Ling, the founder of the Central Institute in Stockholm, which was clearly the model for the Boston school, was not a physician, yet the Central Institute is under the direction of competent physicians, Drs. Murray, Levin, and others.

To have medical gymnastics taught by a doctor of philosophy is the height of absurdity. Is *this* meant to be an improvement upon the Central Institute?

Should Mr. Enebuske omit his proposed instruction in medical gymnastics he would find ample occupation in the hundred lectures and the demonstrations in applied anatomy and physiology and pedagogical gymnastics assigned to him in the prospectus.

See Prospectus Boston Normal School of Gymnastics, 1891–92.

[1] If there is a Metzger school, it is composed of physicians, not of travelling masseurs.

patients, whose susceptibility to the "psychical influence" is so often vaunted, involved in the administering by irresponsible people of an agent valued, as Nebel warns, by the Greeks and Romans for its power to excite the senses.

The physician's instructions to his masseur or gymnast can never be executed with more skill than the quack who trained the subordinate was himself able to bestow.

That such dependence of physicians upon charlatans and their pupils is intolerable will become more apparent as mechanico-therapeutics take possession of one special field after another. For instance, no gynecologist would entrust a masseur or gymnast with administering gynecological treatment. Yet since Thure Brandt forced the discussion of the subject, critical investigation has led to the adoption of mechanical treatment in many gynecological clinics in the Germanic countries, Professor Schultze in Jena having taken the initiative in Germany.[1] Leading ophthalmologists are giving attention to massage, and it is also used in the special treatment of the throat; and in surgical cases in connection with movements to which it is here often subordinate.

These examples illustrate sufficiently the objections to entrusting the administering of mechanical treat-

[1] It is true that Thure Brandt is not a physician, but his talent and the honest faithfulness of his study have won him the recognition and respect of eminent gynecologists. Like Ling, he is an exception upon whose achievements the average masseur can base no arguments. To both men the medical world is indebted for a valuable stimulus.

ment to laymen, however well trained, and especially to people of such training as we have seen.

Mechanical treatment is receiving the attention of leading men abroad not only in Sweden, the home of mechanico-therapeutics, but on the Continent, and especially in Germany, where medical science is most advanced. America is now so closely united in scientific work with Europe that progress here inevitably follows progress there.

There are now in Europe some thirty Mechanico-Therapeutic and Orthopedic Zander Institutes, all under the direction of competent physicians, several of whom have made valuable contributions to medical literature.

Dr. Zander and most of his pupils devote themselves exclusively to mechanico-therapeutics. Leyden, Kussmaul, Erb, Oertel, Nothnagel, Lichtheim, and many others, among them distinguished surgeons, avail themselves of it, to a large extent, in their practice.

In the field of massage, since Dr. Metzger forced renewed discussion of the whole subject, special questions have occupied the attention of Professors Billroth, Mosettig, Gussenbauer, Esmarch, Winiwarter, Thiersch, von Preuschen, Mosengeil; Drs. Berghmann, Helledey, Johnson, Podratzky, Gassner, Gerst, Starke, Naumann, Winternitz, Schede, Zabludowsky, and many others.

While there are quacks in this domain in Europe, as everywhere, they no longer hold undisputed possession of the field. The books which they write meet the treatment they deserve at the hands of competent medical reviewers. The active work of able men within the profession has set a limit to the pretensions

of charlatans. The initiative in the performance of this disagreeable duty in Germany was taken anew several years ago by Dr. Nebel, and the following applies to conditions in America as vigorously as it applied to the state of things in Germany when he wrote it:

"When I urge again and again, Render unto the physician the things which are the physician's, the members of the profession will certainly agree with me. And no sensible officer can feel affronted when we say to the Swedish lieutenants who intrude upon our domain, 'Keep to what you understand, to what belongs to your rank, to your military drill.' And the teachers will not resent our showing up the presumption of individual Turnlehrer [Athletic Doctors of Philosophy !—ED.] who vault into the realm of mechanico-therapeutics, as that physician was shown up with scoffs and jeers who innocently undertook to write a prescription for a lack of foreign phrases !"

Preliminary to the discussion of theoretical questions and the publication of special investigations, it has seemed well to glance briefly, in the foregoing pages, at the state of things here, with the aim of restricting the mechanical quackery and contributing to promote the discussion of scientific mechanico-therapeutics. There is no reason for assuming that the present status is to remain permanent. On the contrary, there are, as we have seen, encouraging indications that subsequent *résumés* will be of a more satisfactory nature.

L. WISCHNEWETZKY, M.D.,

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THE MECHANICO-THERAPEUTIC INSTITUTE.

This is an institution for the promotion of health, in which, as in the ordinary institutes for curative exercise, the healing principle lies in part in exercising the muscles, in part in certain mechanical operations upon special organs or parts of the body. Between the first-named institute and these there is, however, an essential difference, both in the manner of exercising the muscles and obtaining a suitable degree of exertion and in the means used for producing and modifying mechanical operations.

In the ordinary institutes there are certain persons trained for the purpose, gymnasts, who stretch, twist, or bend the joints while the patient offers resistance; or, on the contrary, offer resistance while the patient executes the movements (so-called active movements); or rub, press, and knead the different parts of the body with their hands while the patient remains passive (so-called passive movements).

In Mechanico-Therapeutic Institutes the gymnasts are replaced by mechanical apparatus so arranged that, in the active movements the patient is constrained to use a certain group of muscles to set each apparatus in motion. Thus there is an apparatus for stretching, one for bending, one for turning, one for rolling every member which admits of such move-

ments. In calling forth passive movements divers mechanical apparatus are used which are kept in motion by a steam or gas engine.[1]

In order to form a correct conception of the different value of these two methods of exercise, the "manual" and the "mechanical," it is necessary to ascertain whether the desired end can be obtained with each in a wholly natural manner. The problem is, as has been hinted, to bring about a wholesome vital activity and a harmonious development of the muscular system by exercising the muscles. Physiology teaches that the law for all organic development is that of gradual growth; so that an increase in muscular strength is not possible without that which produces the increase, namely, work, *i.e.*, exercise adapted from the beginning to the reserve of strength and increasing only by degrees in proportion to the increase of that reserve. If the work exceeds the strength, over-exertion follows which necessarily brings a diminution of strength in its train. If, on the other hand, the work is too light, its strengthening effect ceases and the time is wasted. Hence it is necessary to have ascertained for every patient the effort which corresponds to his different muscles, and to continue to make just that measure of effort until the patient distinctly feels that it is too slight. Then it may be increased so as to require the same degree of exertion as before. Now which of the two methods of exercise fulfils this requirement best? This question should be as readily answered as the following: "How is the weight of an

[1] The New York Institute has introduced a seven-horse power electric motor.

object more exactly ascertained, with the hand or the scales?" It is easy so to arrange an apparatus that it works with a certain maximum, a certain minimum, and all intermediate grades of force. For instance, if the patient is to bend his arm, the apparatus for that purpose is first set for slight resistance. If this proves too slight, the resistance is increased until the patient is required to make a moderate effort in overcoming it. The measure of this effort is to be found on the scale of the apparatus. The number is noted. If it is apparent, after the exercise has been continued for some time, that the former slight exertion has entirely ceased, the muscular strength has, of course, increased, and the apparatus must, therefore, be again adjusted for increased resistance. Thus the patient knows his strength and can adapt his movements to it. The gradual development of muscular strength cannot be accomplished in a more perfect way.

Since the same exertion made by a feeble patient often produces greater weariness on one day than another, it is important that modifications in the vigor of the movements corresponding to this circumstance should be readily possible.

This is accomplished in the following manner: The patient's prescription has upon it a note showing what resistance suited him yesterday. To-day he feels less strong, and mentions the fact to the physician or instructor, who correspondingly reduces the grade of effort in all the movements, or in those only which produce greatest weariness. In making the movements the effort is still farther modified, either by continued reduction or by repeating each one a smaller number of times. No movement is ever made so vigorous that,

on being repeated once or twice, it could involve danger even for the feeblest patient.

The mechanical method thus requires of the patient a certain degree of activity, reflection, and interest in the matter, and this may be a trifle burdensome to one or another; but it does not follow that the avoidance of this exertion would be a gain. On the contrary, it is well to have something prevent the patient from falling into that state of indifference so enticing to certain natures and certain states of debility. Children are under constant supervision. The instructor has a trustworthy guide in the child's appearance and in the manner in which it executes the movements, for judging the suitable degree of vigor of the movements.

In using the mechanical method there is always a certain measure of the increase of exertion which every patient may venture for the purpose of obtaining a uniform growth of strength. The correctness of the opinion formed upon this point is tested daily and at each period of exercise. The prescriptions upon which is noted each new modification contain the most precise description of the change and growth of the patient's strength.

The apparatus for *passive* movements are also graded so that the degree of their operation can be exactly adapted to the varying requirement.

The double possibility of making all these modifications and using a specific term for each of them, forms the advantage of the mechanical method. Herein lies, indeed, the condition of a really scientific application of mechanical treatment.

In this way only can a certain, precise knowledge of

the development of the different muscles be obtained ; in this way only can the most suitable degree of energy of the healing agency (muscular activity or mechanical operations) be ascertained. In this way only can the practice of mechanico-therapeutics accumulate trustworthy information for affording exact insight into the changes of energy of the nervous and muscular system connected with different pathological conditions.

Another important advantage of the mechanical method consists in the uniformity of the movement. A movement is uniform when the strength exerted corresponds throughout to the resistance. Since the muscles work chiefly upon levers (bones) and the force applied to a lever varies greatly according as the lever forms an acute, an obtuse, or a right angle to the line of the force, it follows that either the resistance or the energy of the muscular contraction must be changed unceasingly, corresponding to these angle relations, if the movement is to be a uniform one. It is clear that in this case the movement is more wearisome. There will necessarily be more nervous energy required when a series of contractive impulses of varying intensity are required than when such variations of intensity of innervation are not needed. Exercises of this sort disturb and weary feeble patients. It is therefore necessary that the resistance should correspond to the varying mechanical relations engendered by the changing position of the lever. In the mechanical method this is readily accomplished by furnishing resistance through levers which modify it just as the natural levers modify muscular force.

If we turn to those who use the manual method with

the question: "How does the gymnast proceed in order first, to adapt his resistance to the strength of each patient, and second, to afford the equable increase and decrease of resistance referred to?" we receive the reply: "The gymnast possesses, by means of his trained susceptibility, the power of determining for every patient, at any moment of the movement, the degree of effort which best corresponds to the patient's strength and to modify his resistance accordingly." If the correctness of this statement is for the moment accepted as undisputed, there remains still another question: "How does the manual method provide for the frequent cases in which the wholly unpractised patient furnishes the resistance?" For it is naturally the person furnishing the resistance who directly determines the vigor of the movement. The other has merely to overcome this resistance or to state that he finds it too strong or too slight. The value of such a suggestion for the patient as a guide in developing the correct degree of force is easily seen. In the mechanical method the patient's effort remains uniform, whether he is overcoming the resistance of the apparatus or whether he himself furnishes resistance to the apparatus. If the first effort was found to correspond to his strength, the latter must also correspond. In these movements the gymnast, be he never so practised, can never guarantee that the patient is not over-exerting himself or making too slight a resistance.

We have assumed, thus far, that the gymnast, when he is himself offering resistance, is able really to adapt it to the requirements of the patient. This presupposes that those persons only are employed as

gymnasts who, possessing natural qualifications (for such are necessary), have acquired this power by long and faithful practice. Knowing how laborious is the profession of the gymnast, the question remains an open one whether, with all due recognition of his good intention, it can be possible for him to exercise the skill acquired, day in and day out, with equal conscientious precision. It is a universally acknowledged fact that the muscular sensibility of the hand is dulled after an effort. Thus after an exertion of the strength of the right hand, it is more difficult to write, play, or draw.

Since the gymnast must give movements which are now very slight, now very laborious for him, how can it be possible that the sensitiveness of his hand should remain uniform? However skilled and hardened a gymnast may be, he will be more or less weary at the close of an hour's practice, and his sensitiveness will be correspondingly diminished. Moreover, he, too, will be subject to the same accidental influences which diminish the mental and bodily vigor of other persons! And must not these diminish his ability to feel and judge? This question can be answered only with the admission that the manual method, even under the most favorable circumstances, *i.e.*, even when it has the most skilful gymnasts at its disposal, affords no security that the vigor of the exercises steadily corresponds to the strength of the patient.

Assuming, however, that such an arrangement were practicable, that the gymnast need not work when weary or indisposed, and that in order to maintain a high degree of sensibility some gymnasts make only

the more violent movements and others only the less vigorous ones, would all the requirements which curative exercise must make upon those who administer it then be met? The gymnast adapts the effort to his conception of the patient's available strength. What determines his estimate? He feels *how* the patient executes the exercise; if tremblingly, spasmodically, or with visible effort, the gymnast concludes from this that the exertion is excessive, and he diminishes his resistance until these symptoms disappear and then he thinks the exercise suitably vigorous. But is this always the case? The mechanical method can here furnish information which the manual cannot possibly obtain.

By means of a graded apparatus, it is possible to ascertain not only with certainty the highest expenditure of force which the patient can undergo without incurring the symptoms referred to, but the grade of effort also at which the reaction of the heart does not exceed certain degrees. In those affections (cardiac troubles) in which this reaction is strong even with comparatively slight movements, the available strength of the patient cannot be taken as a standard for the energy of the movements, for exercises which the patient can execute without visible exertion and without a feeling of weariness may, nevertheless, cause palpitation of the heart and breathlessness. The vigor of the exercise must, therefore, be made so slight that these symptoms do not appear. The measure of exertion determined in this way, and farther reduced if the patient should chance to feel more than usually weary, must be persisted in for some time, until it is found that it can be increased a little without heightening the re-

action of the heart. In this way the so easily overstimulated action of the heart may be gradually calmed, to the great relief of the patient, who had formerly been unable to make the slightest exertion without palpitation and breathlessness. I would cite one more illustration that the present strength of the patient cannot under all circumstances serve as a standard for determining the grade of the movement. It frequently happens that the patient, who did not feel weary immediately after the exercise, notices a troublesome sense of fatigue toward evening, accompanied at times by headache and divers nervous sensations. On the following day the movements must be slighter than the patient believed himself able to endure previously, and since we know precisely how strong yesterday's movements were, the mechanical method having been used, this is an easy matter. But what has the gymnast to do in such cases? He must not judge by the momentary strength of a patient, yet that is the only clew which he possesses for determining the energy of the movements.

In the foregoing criticism of the manual method, I have assumed the premises most favorable for it, *i.e.:* First, *that the gymnast can really adapt his resistance to the strength of the patient, and,* second, *that such gymnasts only as have acquired this power are employed.* But we have already seen that, in part, those influences to which all human beings are subject, decidedly modify the power in question; and, in part the circumstances which should direct the gymnast in exercising his art (the momentary strength of the patient) mislead him and destroy the results of his labors. How far the latter of these suppositions rests upon

actual facts, everyone who has had any experience in the matter can judge for himself.

In relation to the first assumption I would add that I cannot believe it possible. Nor is there any prospect of arriving at definite certainty, for the assumption is of a sort which eludes every attempt at proof. Certainly, the following assertion cannot be accepted as such, viz. :

"The exercise carried out by the patient steadily, not jerking, without trembling or visible effort, indicates the available strength of the patient." For the same indications apply to exercises far below the power of the patient. On the other hand, the following criterion for measuring strength is infallible. The exercise *next below* that grade in which the movement begins to be trembling or spasmodic indicates the present strength of the patient. But how can it be ascertained that the exercise given by the gymnast is not too slight? It cannot be ascertained, for such certainty can be arrived at only by comparison, and strength which cannot be measured cannot be compared. On the other hand, it can be said with certainty, "In using the apparatus for arm flexion, trembling became perceptible at resistance No. 10 and disappeared at No. 9."

It may be objected that, despite a certain imperfection, many admirable results must be attributed to the manual method, and that the defects here cited cannot, therefore, be very considerable. But I would urge in reply that the gravity of the defects cannot be judged by the fortunate results, and if there is a method which is free from these defects, it becomes a duty to use such method whenever possible.

It is of the nature of things that the mechanical method cannot be carried on upon a small scale as can the manual, which in cases of necessity can be taken into the home of the patient. But even where mechanical treatment is administered on a large scale and with the most perfect apparatus, the hand must be called into requisition in the treatment of affections of the organs of motion for executing the manipulations now so generally known under the name "*massage.*" Desirable as it is that this treatment, which is so wearing for the masseur and so expensive for the patient, should be administered by means of apparatus, there are insuperable obstacles in the way of such procedure. For the masseur must constantly judge, by means of his sense of touch, of the anatomical and pathological conditions of the tissues upon which he is working in order to vary appropriately the direction, the kind, and the vigor of his manipulations.

It is now thirty-four years (1857) since I made the first attempt to create a complete system of exercise by means of mechanical apparatus, while I was directing the exercises of a large girls' school in the country. As I tried Ling's appliances and free exercises in line, and was obliged to reject both, the former because they were not suitable for girls, and the latter because they failed to afford the required variety and the needed individualizing of movements, especially in the case of certain delicate girls suffering from spinal curvatures, there remained nothing else to be done but to use the manual method myself for more or less modified curative exercises. But the insufficiency of my strength for this gave rise to the thought that I

might substitute mechanical apparatus for it. I hoped that I might in this way avoid some of the inconveniences of the manual method which I had known as a patient and teacher of physical culture.

I conceived of my task as follows: If a mechanical apparatus could be so arranged that a certain group of muscles must be used in order to set it in motion; if this apparatus could be provided with a balance-weight which could be increased or diminished at will, and, finally, if the resistance could be so managed as to increase or decrease gradually in harmony with the laws by which muscular power works, the problem would be solved, and a therapeutic agency gained which would not only supplant the gymnast but readily overcome even those difficulties with which he had struggled in vain. According to this plan, experimental apparatus for the most important exercises were prepared and, although the first apparatus were very imperfect, I was not deceived in my hopes. I could individualize the exercises perfectly for every pupil, and after a few attempts I could determine precisely with how vigorous exercises each one should begin, slowly and almost imperceptibly increasing the resistance. The uniformity and steadiness with which the powers increased in this way was truly astonishing, and even the feeblest of the children showed in the briefest time progress which could be weighed by the pound, to say nothing of increase in appetite and keener joy in life. During the brief time that I was able to give each year to these studies I constantly increased and improved my apparatus. But as they grew more expensive in proportion as I learned to perfect them, it became clear to me that mechanical treat-

ment could achieve the development and perfection of which I believed it capable, only in a larger sphere in which greater capital should be at my command.

After I finished my medical studies in 1864 I succeeded in obtaining the support of certain friends for founding an Institute for Mechanico-Therapeutics in Stockholm. This was, at the opening, January 2, 1865, furnished with twenty-seven apparatus. I invited the medical profession and the public to examine the new method and appealed to their judgment, as I knew that the representatives of primitive methods with primitive means were far from giving my undertaking a friendly reception. That this appeal was received in a manner cheering for the cause may be seen from the following statement of the number of patients from the opening of the Institute to June 1, 1878.

		Men.	Women.	Total.
Spring,	1865	80	52	132
Year,	1865–1866	182	147	329
"	1866–1867	167	124	291
"	1867–1868	276	155	431
"	1868–1869	299	166	465
"	1869–1870	306	165	471
"	1870–1871	320	122	442
"	1871–1872	468	179	647
"	1872–1873	484	152	636
Spring,	1874	428	133	561
Year,	1874–1875	590	180	770
"	1875–1876	651	279	930
"	1876–1877	688	210	898
"	1877–1878	593	216	809

These patients, of all ages from four to eighty years, presented all those ailments which had formerly been treated by the manual method, and also persons who,

without any specific malady, used the exercise for its general strengthening qualities and as a preventive for the evils attending sedentary occupations and employments which require one-sided exertion of certain muscles (*dietetic exercise*). There were also school childen who were found too feeble for the ordinary school exercise and were, therefore, relegated to this the most perfect of all *pedagogic* or development exercise.

Mechanico-Therapeutics work, as a rule, slowly. It is only rarely that they can produce prompt results. Their aim is to help the sufferer to work with patient persistence for that balanced state of the whole organism (proportion between the function of the muscles and the other organs) which may either have been disturbed for years or suddenly disordered (as in the case of fractures, luxations), with deeply reaching results requiring long, persistent, assiduous effort for their restoration.

The success of mechanical treatment must, therefore, bear a direct relation to the persistency with which it is carried on.

For certain affections, those of the heart for instance, treatment remains a permanent necessity, at least for the winter season. Truly to be pitied is every patient who is deprived of opportunity to avail himself of it. The beneficent effect of *regular*, *slight*, but manifold muscular exercises upon diseases of the heart is surprising. Some of these can, when not too far advanced, be wholly overcome. Others can be checked in their development and all can be modified in their symptoms. I have had patients in the last stages of suffering from valvular defects. They knew that a cure was impossible but were happy to go on with the exercise so long

as their failing strength permitted them to visit the Institute, for the sake of the relief which the treatment afforded them. For a multitude of chronic disorders, such as those of the heart, lungs, bronchial tubes, catarrhal affection of the stomach, intestine, and bladder, habitual constipation, hæmorrhoids, pelvic troubles, lameness, cramp, affections of the joints, curvature of the spine, deformities, etc., mechanico-therapeutics command certain forms of movements which attack the malady more directly; but no less important is the indirect influence which general strengthening and vitalizing physical exercises produce. Thus it would not be possible for any of the maladies enumerated to develop to a high degree without diminishing the vitality of the body and the general health. This general health that finds expression in the energy with which the living organism resists external injurious influences, or in the perfection wherewith the remaining organs work together to meet *those* dangers to the whole organism which are engendered by the accidental over-exertion or under-exertion of any one member, the more perfectly this health can be maintained, the more independent it renders the individual of those manifold internal and external influences which limit his mental and physical activity. It even enables him at times successfully to endure tests to which a less vigorous nature would succumb.

By prolonged or repeated illness this beneficent reaction of Nature against disease is diminished and the regaining of health is rendered proportionately more difficult. In single cases, special treatment may be able to remove the original disorder, but a condition

of debility continues, which exposes the patient to relapse or new affection. In other cases special treatment remains ineffectual, until by generally strengthening treatment the vital energies have increased and the powers of recuperation latent in the organism are again aroused to life.

The generally strengthening effect promotive of all the vital activities which is possessed in so high a degree by systematic bodily exercise is, therefore, of the utmost importance in the treatment of chronic ailments, and during convalescence after acute illness. But it is not alone through illness that the vitality is undermined. Senseless habits of life, intemperance, lack of light, air, and bodily exercise, especially during one-sided over-exertion of the intellectual powers, all this consumes vitality and makes life from childhood to old age a sample-book of maladies and infirmities of all sorts. It is the part of dietetic exercise to prevent this misery so far as it rests upon insufficient or one-sided physical exercise. In the performance of this office the mechanical method has one extremely important advantage over the manual, in that it can be applied on a large scale. The great majority of every city population obtain through their wonted occupations a wholly insufficient or most one-sided and, therefore, often injurious form of bodily exercise; for all these, dietetic exercises are an actual and permanent necessity, as every one must see who is in any way clear as to the importance of the muscles. This apparatus for moving and for developing strength was given us because bodily exertion was originally an indispensable condition of our existence. By bodily exertion our food was ob-

tained, and surrounding impending dangers had to be warded off by physical effort. In proportion as civilization progressed there has been developed such a division of labor that now a multitude of members of human society need to use their physical strength, or perhaps, almost exclusively, their mental powers, only in the most one-sided manner for the performance of the duties of their vocation. Yet their organism is by no means so changed as to render physical exercise superfluous for them. It is known that in the living organism the natural activity of every organ is an indispensable condition for the continuance and health both of the organ in question and of the whole body. This is true at least of all organs which exercise any influence upon the nutritive process. It is, therefore, clear that organs such as the muscles, which, besides forming the largest part of the body and embracing such important parts of the circulatory and nervous systems and making such demands upon these for muscular activity, have for their especial function the promotion of the circulation of the blood—that such organs cannot be left idle without disturbing the health of the whole body and undermining its vitality. And when we see the ceaseless and manifold movements with which the child instinctively labors for the development of its muscles, the question naturally arises: Is it possible that a system of organs upon which instinct teaches us to expend so much effort in youth can be almost wholly neglected later, and we still go unpunished? If civilization has made less generally necessary for us the powerful physical development which our ancestors required, bodily exercises, nevertheless, remain a ne-

cessity founded in our very nature, and not to be pushed aside without injury. Daily experience convinces us in unmistakable fashion that a sedentary life, or too one-sided physical activity, bring affections of the heart, anæmia, pelvic derangements and a multitude of other disorders in their train, such as headache, dizziness, backache, shortness of breath, constipation, colic, hæmorrhoidal troubles, cold feet, etc.

Yet the neglect of physical exercise is almost universal! People think they need no motion beyond a daily walk. Do such persons know what good health really is? They learn, at last, what good health is *not*, when some accidental trifle calls upon them for something more than the strength of their leg muscles and convinces them of their feebleness and lack of resistance, or inflicts upon them a congestion of the brain, a hemorrhage of the lungs, a defect of the heart, a hernia or a sprained joint, a broken leg, or some other misfortune which a stronger or more harmoniously developed physique might more readily have escaped.

The great army of officials, teachers, professors, merchants, who lead a sedentary life, or one permitting only most one-sided movements, can rarely be ignorant of the utility and necessity of orderly bodily exercise. But how many of them feel at liberty to sacrifice an hour a day, some months in the year for the purpose? If each one would but make a simple calculation of the working time and working power lost by many petty maladies and discomforts, or of the length of time during which his will power can continue to govern his body weakened by neglect! Does anyone really believe that the chronic excess of blood in the brain, caused by laborious mental activity, and

rarely or never effectively relieved, or the pelvic congestions caused by a sedentary way of life, or contraction of the chest by stooping over the writing-desk, can fail to undermine health and working power prematurely?

As to the health of women, especially, it is one of the prejudices most unfortunate for our race that bodily exercises should be regarded as superfluous for women. Is the vocation of women in this world so insignificant or so unimportant that it can be a matter of indifference whether in filling it and performing its duties they enjoy good, substantial health? Are not women misapprehending their duty when they live in a state of weakness which affects injuriously the vitality of coming generations and makes themselves burdens upon those about them, apathetic and incapable of useful activity? If any one needs a superabundance of vitality it is certainly the woman who is to give life to other beings!

Women do not need powerful muscles. It is rather the nervous system and the organs performing vegetative functions which are of the highest importance to them. But since muscular exercises form an efficient means, for which there is no adequate substitute, of keeping the nerves and other organs in a wholesome and thoroughly vitalized condition, they must be equally necessary for men and women. They are, moreover, of especial importance for women as a preventive of certain pelvic disorders.

During pregnancy a number of carefully selected, cautiously executed muscular exercises are of great utility, not alone for their beneficent influence upon the general health throughout that period; repeated

observations have shown that after such preparation confinement and recovery have taken a more favorable course than in previous cases in which there had been no systematic exercise.

For the female as well as the male organism muscular activity is an important curative agency. Although the differences referred to involve especial, distinctive requirements for men's and women's exercise in the manner and degree of exertion, there remains one main qualification common to both, namely, a harmonious development and exercise of the whole muscular system. This requirement of completeness is indispensable in dietetic and educational exercise. But the modifications which exercise for women requires in physiological and æsthetic respects must never be sacrificed to it. Those methods which, for the sake of getting at certain groups of muscles, involve violent or æsthetically objectionable starting positions, or which do not admit of a perfectly individualized vigor of movement, *i.e.*, adaptation to the requirements of each individual's strength, are especially to be avoided for women and girls. Among all the methods used for this purpose, the mechanical best meets the requirements of complete and individualized exercise of the muscles. Each separate group of muscles which can be called upon during the exercise has its corresponding apparatus by which, in each case, the exertion is limited to precisely the muscles meant to be called into use. Moreover, the resistance can, as has been shown, be most exactly adapted to the strength of each muscle. It is clear that, in this way, the exertion can be more uniformly distributed, and it is just this uniform distribution

adapted to the state of development of the different groups of muscles, which causes the feeling of health and accumulating strength that one-sided physical exercise never engenders.

In arranging systematic exercise for school-girls, there are to be kept in mind a special and a general object. The general aim is a harmonious development and strengthening of the body, the special task is the acquirement of grace and flexibility of movement. The first object is best obtained by the mechanical method, the second by free balancing exercises. But precisely because these latter have a special object, they are to a certain degree one-sided and, therefore, more wearisome and laborious. (The *extensor* and *abductor* muscles of the legs are almost constantly in use, the *flexor* and *adductor* muscles most slightly exercised.) Since, moreover, the degree of effort cannot be measured according to the strength of the pupil, but depends upon the weight of the body or extremities, it is clear that these exercises in balancing should not be used before the pupil has attained a certain degree of physical development. One-sidedness and difficulty in individualizing characterize the dumb-bell and Indian-club exercises usual in other countries. The so-called ring exercises, too, are very unsatisfactory, though they permit a more varied exercise of the muscles of the arm and body. But in these exercises the grade of effort depends upon the fellow-pupil, who, though of about the same size, may be considerably stronger or weaker. This, by the way, is merely a part of the manual method in which the gymnast is replaced by a child who is either too feeble for the task assigned to him, or, if stronger

than the comrade, cannot possibly have such control over his muscles as not even a trained gymnast acquires.

In all these exercises it must be assumed that the pupil is perfectly sound. If he is sickly, ill-developed, or actually deformed any exercises other than mechanical are out of the question unless, by reason of especial circumstances, manual treatment by or under the supervision of a competent mechanico-therapeutist is required.

For that unfortunately large number of our school children for whom participation in the common gymnastics is forbidden by the physician, the mechanical method would seem to be the only alternative. For my own part, I am convinced that no really thorough physical education is possible without the help of this exercise, though I admit, of course, that for pedagogic purposes it alone would be insufficient. However, this important point requires a far more thorough discussion than the limits of this essay permit.

The Mechanico-Therapeutic Institute in Stockholm now embraces 95 apparatus, 60 for divers movements and 35 reserve apparatus. They are all indicated by a letter and a number.

The apparatus for exercise are divided into three series, according as they are meant to be set in motion or to work by pressure (correctively).

Series I.—Apparatus set in motion by the muscular power of the patient.

Series II.—Apparatus set in motion by some motor, such as a steam or gas engine or electric motor.

Series III.—Apparatus intended to exercise corrective pressure upon the frame, or to stretch the

elastic parts of the body, either by means of the weight of the patient or by a mechanical contrivance. According to the nature of their physiological effect they are divided into four parts :

1. For Active Movements, *i.e.*, such as have for their direct object the exercise and development of the muscles. This division is subdivided into four groups :

A. Active arm movements.

B. Active leg movements.

C. Active trunk movements.

D. Balancing exercises.

2. For Passive Movements, *i.e.*, such as move the members of the body without the help of the muscles, stretching or softening capsules, ligaments, and muscles. This division embraces but one group.

E. Passive movements.

3. For Mechanical Operations. This division embraces four groups :

F. Vibration.

G. Percussion.

H. Kneading.

J. Rolling and friction.

4. Orthopedic Apparatus for treating curvature of the spine. This division contains two groups.

K. Apparatus for reclining, intended to exert a corrective influence upon abnormal curvatures of the spine by means of suitable pressure.

L. Apparatus for exercises by means of which certain movements are meant to exert a corrective influence upon the abnormal curvatures of the spine.

When these eleven groups are distributed in the above-mentioned three series, then :

Series I. contains groups A, B, C, and L.
Series II. contains groups D, E, F, G, H, and J.
Series III. contains group K.

The individual apparatus belonging to each group are indicated by the letter of the group, with a number. The following table shows all the apparatus now in existence. Certain numbers are omitted in certain groups. They belong to apparatus which are not yet complete but are expected to take their proper places in the near future.

I.—Active Movements.

A. Active Arm Movements.

A 1. Arm sinking.
A 2. Arm raising, shoulder raising.
A 3. Arm sinking and bending.
A 4. Arm raising and stretching.
A 5. Drawing arms together (adduction).
A 6. Drawing arms to the side (abduction).
A 7. Throwing the arms (circumduction).
A 8 *a.* Arm rotation.
A 8 *b.* Arm rotation in turn.
A 9. Forearm flexion.
A 10. Forearm extension.
A 11. Hand flexion and extension.
A 12. Finger flexion and extension.

B. Active Leg Movements.

B 1. Hip flexion.
B 2. Hip extension.
B 3. Hip knee bending and hip raising.

B 4. Hip knee extension.
B 5. *a* Adduction of the leg seated.
B 5. *b* Adduction of the leg (half reclining).
B 6. Leg abduction.
B 7. Velocipede movement.
B 8. Leg rotation.
B 9. Knee flexion.
B 10. Knee extension.
B 11. Foot flexion and extension.
B 12. Foot circling.

C. Active Trunk Movements.

C 1. Trunk bending forward (seated).
C 2. Trunk stretching upright.
C 3. Trunk bending forward (lying).
C 4. Trunk stretching, long sitting.
C 5. Trunk stretching, standing
C 6. Lateral flexion of trunk.
C 7. Trunk rotation.
C 8. Pelvis rotation.
C 10. Neck extension.

D. Balancing Movements.

D 1. Trunk balancing.
D 2. Trunk rotation, seated sidewise.
D 3. Trunk rotation, seated astride.

II.—Passive Movements.

E 2. Passive hand flexion and extension.
E 3. Passive radial and ulnar flexion of hand.

E 6. Chest expansion.
E 7. Passive pelvis rotation.
E 8. Pelvis lifting.

III.—Mechanical Operations.

F. Vibration.

F 1. Vibration.
F 2. Vibration in the saddle.

G. Percussion.

G 1. Percussion.
G 3. Leg percussion.
G 4. Trunk percussion.
G 5. Head percussion.

H. Kneading.

H 1. Abdomen kneading.

J. Friction.

J 1. *a* Arm friction.
J 2. *b* Finger friction.
J 3. Leg friction.
J 4. Foot friction.
J 5. Back rolling.
J 6. Circular abdomen rolling.

IV.—Orthopedic Apparatus.

K. Reclining Apparatus.

K 1. Lateral suspension reclining.
K 2. Lateral pressure.
K 3. Thorax rotation.
K 4. Straightening chair.

L. Exercise Apparatus.

L 1. Combination of A 3 and D 1.
L 2. Horizontal position.

Measurement Apparatus.

Trunk measurement.
Transverse measurement.
Examining chair for scoliosis.

These apparatus are distributed in four large rooms, embracing 4,265 square feet of floor space.

The Institute contains also two consulting-rooms, a reading-room, a retiring-room, one for electricity and massage, a room for the sale of mineral water, a store-room, sleeping-rooms for the engineer and the ladies' maid, and a space for the engine. In this space there is a gas engine of 10-horse power, of which but 5 to 6 are used at present. The gas engine moves thirty-eight apparatus for passive movements, an air-compressor for atomizing medicated fluids, an elevator, and a ventilator.

The following persons are employed in the Institute, viz.: Three physicians, two male and seven fe-

male instructors, who help the patients in the use of the apparatus; twelve boys and twelve girls, who adjust the apparatus according to the prescriptions; a mineral-water seller, a cashier, an engineer, a door-boy, and a ladies' maid. In the course of the past year there were 14,000 bottles of mineral water used in the Institute, 1,859 applications of electricity, 2,740 of massage, and 628 inhalations.

The institute is open from September 20th to May 15th, five hours daily for men, and three for women.

There are now institutes in Göteborg, Orebro, Norrkoping, Abo, and Upsala.[1] All these institutes have been supplied with apparatus by me.

My apparatus have received the following prize medals: Hygienic Congress in Brussels, 1876, bronze medal; Centennial Exposition, Philadelphia, 1876, bronze medal; Paris Exposition, 1878, silver medal.

Besides this the Academie Nationale in Paris conferred upon me a "Medaille de Première Classe."

STOCKHOLM, 1891.

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[1] Since the publication of the original edition of this pamphlet in 1879 institutes have been founded in Berlin, Vienna, London, St. Petersburg, Moscow, Munich, Dresden, Frankfort, Hamburg, Baden-Baden, Leipsic, Budapest, Wuerzburg, Kissingen, Mannheim, Carlsruhe, Wiesbaden, Breslau, Copenhagen, Helsingfors, Hjulsta, Pforzheim, Christiania, Buenos Ayres, and New York.

Application for an equipment of apparatus for an institute in connection with the University Hospital has been made to Dr. Zander by Dr. William Pepper, Provost of the University of Pennsylvania (Philadelphia).

Preparations are also being made for an institute in Boston, to be connected with the medical school of Harvard University.

The Johns Hopkins University has obtained from Dr. Zander the right to establish an institute in Baltimore.

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" No. 3. THE MECHANICAL TREATMENT OF CHOREA, by Dr. Hermann Nebel.

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