



ULTRASONIC  
AND  
ULTRASHORT WAVES  
IN MEDICINE

*by*

JOHANNA M. VAN WENT, M.D.

DIRECTOR INSTITUTE FOR PHYSICAL MEDICINE AND RHEUMATISM  
AMSTERDAM

*Introduction by*

KENNETH PHILLIPS, M.D., F.A.C.P.

DIRECTOR PARKWAY MEDICAL CLINIC, AND  
DEPT. PHYSICAL MEDICINE JACKSON  
MEMORIAL HOSPITAL, MIAMI, FLORIDA

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## PREFACE

Physical medicine at present comprises not only the application of various stimuli to the body, but also the investigation into the changes brought about.

The earliest applications were empirical.

CHARLEMAGNE is reported to have discovered the favorable effect of drinking the mineral waters at Aix-la-Chapelle, others used them for curative bathing. It was not until later that the action of these stimuli was investigated.

FINSSEN found, by experiments with sunlight on himself, the method of using light-treatment on others; these investigations placed him among the pioneers of the scientific development of physical medicine.

The present procedure is as follows: a new therapeutic method is first investigated physically and chemically; then its biological effects are tested by experiments on animals, subsequently personal experiments are carried out (such as FINSSEN did), and finally it is clinically applied.

It is clear that this procedure leads to a certain safety as regards the treatment, but further investigation is necessary for constant improvement and for solving new problems which may arise. This course of action will no doubt increase confidence on the therapeutic value of physical medicine. How necessary this is, is proved by the number of 'unbelievers' who do not attribute any effect on the human body to this specialised form of therapy, or see at most only a 'psychic' influence, ignoring the objectively demonstrable changes which may be effected.

Even the Romans were convinced of the effects of stimuli on the human body, in support of which I will only call to mind the

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splendid *thermae* of ancient Rome, the use of massage, and the fact that they made use of the mineral springs in the Vosges, witnessed by the coins found in the water at Plombières.

The branch of physical medicine called *physiotherapy* is a special form of treatment.

If we regard disease as a lack of resistance, then it is clear that if we can raise the resistance of the patient's body so that it is able to defend itself against the pathogenic agent, there is a fair chance of the disease being overcome or of the patient's condition improving. An attempt in this direction is made by administering stimuli which ultimately influence the cells. The nature of the stimuli to be given will have to vary in accordance with the disease and the patient's condition. We will not only have to bear in mind the type of affection when determining the physiotherapeutic method to be used, but also (for the same disease) must consider the patient individually, as there might be some contra-indication in a given case. A primary requirement is, however, that the patient be capable of reacting. It may happen that a patient is weakened to such a degree that he can no longer react to stimuli. If such stimuli are nevertheless applied, this may have either harmful consequences for the patient, or no favorable result will be obtained.

Of further importance are the amount of the stimulus and the checking of the patient's reaction; these must be judged by the physician himself and never by the nursing staff. I shall revert to this in detail in Chapter 3.

Finally a few words on the action of the stimuli. Every stimulus may disturb the equilibrium of the cell. This disturbance may be great or small, irreversible or reversible. Violent stimulation (too large a dosage) involves the risk of irreversibility. Stimuli can be given which change constantly in direction (ultrashort waves, frequency 50 million per second). As a result of this rapid change, it may be assumed that the second stimulus will reach the cell in the latent period of the first one, and so on, so that the equilibrium of the cell

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will be maintained. Energy will be left behind in the tissue. How this acts must be a matter of further investigation. To obtain favorable results, it is necessary to work with minute doses; not only may direct damage be avoided in this way, but it will also be possible to continue treatment over a protracted period of time, if necessary. In case of overdosage we must usually wait a long time before treatment can be resumed; thus precious time is lost. The physician must, before each treatment, check up on the patient's reaction to the previous course. On the strength of this reaction he can determine the next dose. As a rule two sessions per week are sufficient. An exception to the rule is the ultrashort wave treatment of acute inflammations (boils, carbuncles, mastitis, etc.). I shall come back to this more in detail both in regard to ultrasonic and to ultrashort wave treatment. In conclusion we may say that physical therapy is a method of treatment which brings the body into a condition capable of conquering the pathogenic agent. This form of therapy is worthy of application on as large a scale as possible not only for its own value but also because no agents are introduced into the body that must later be excreted again.

The following chapters deal in detail with the action of ultrasonic and ultrashort waves.

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JOHANNA M. VAN WENT

## INTRODUCTION

by

KENNETH PHILLIPS, M.D.

*Fellow American College of Physicians  
Fellow International Gastro-Enterological Society  
Member American Therapeutic Society  
Director Parkway Medical Clinic  
Director Dept. Physical Medicine  
Jackson Memorial Hospital, Miami*

Any recipient of this treatise who does not read Van Went's 'Preface' will deprive himself of proper orientation relative to the depth of her subsequent chapters. In the Preface she emphasises the fundament concepts so necessary to proper analysis of clinical value of physical energies. The thread of her viewpoint concerning disease itself is a refreshing deviation from the routine published concepts of the most authors writing upon the therapeutic values of these energies. Any rheumatologist currently informed, would immediately tie in this emphasis with that of H. Warren Crow, of London, not only for the unity of concept, but more important, the fact that it has been pitifully neglected by the masses who expound upon the treatment of diseases, regardless of the therapeutic agent under discussion.

The time has arrived that therapeutic scientists must broaden their concepts to include a knowledge of physiology, pathology, neuropsychiatry and immunology in relation to the treatment, before they claim and expound any therapeutic agent, be it physical or chemical. Van Went has covered a substantial thought in these phases, in her discussion of a single word 'Stimuli'. This word, as she uses it, pulls us away

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from our routine conceptions and emphasises that the actual effects of physical energies are beyond the skin, superficial tissues and fluids.

Therapeutic scientists many times become endangered by a subconscious ego that they individually apprehend in the entire mystery and not infrequently use established prestige to rebuff or slay contentions of the so-called 'Lesser Lights'. This is dangerous, because sometimes futuristic knowledge produces explosion and chagrin to that type of dogmatism.

Relative to Ultrasonic energy itself, dogmatists are shouting 'heat' as the entire answer, just as some years ago they shouted 'heat' as the answer to short waves, ultrashort waves and artificial fever therapy.

Within the chapters will be found adequate discussion of physiological effect of Ultrasonic energy, other than heat.

The chapters discussing ultrasonic energy being capable of driving drugs into the superficial tissues (now accepted as Phonophoresis), dosage, continuous versus pulsed energy, stationary and movement technic, will all bring forth controversial opinions. This will be favorable, because it will serve as a starting point to reach two imperative goals (1) to subdue a present existing undercurrent branding ultrasonic energy, even in therapeutic doses, with an alarm and danger tag; (2) serves as a step in unifying and standardizing dosage and technic of application, so that workers geographically separated can understand each other.

Short wave has undergone a longer test of seasoning. Despite this additional experience, the physiologist cannot avoid annoyance and amazement toward the predominant clinical acceptance that 'heat and heat only' is its total therapeutic answer.

The chapter on irradiation of the hypophysis and the endocrines will prove of interest to all. This application of (ultra)short wave energy is familiar to pioneers in physical medicine but may appear new to those more recent in the field.

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And so this book will justify its place in the archives of scientific history. At the moment it is a credit to the inestimable hours of effort spend by the author. As time passes and experience increases, it will be complemented and supplemented; but if studied it should hold its place, even in future, alongside other volumes which stand as monuments to men and women who devoted their all to the welfare of human health and survival.



## ERRATA

- p. 6, line 2, *for react to read take on.*
- p. 7, line 8, *for faster read further.*
- 9, in the legend of Fig. 2, *for LINQUIST read LINDQUIST.*
- 54 line 8, *delete See.*
- p. 72, in the descriptive text of the figures, *for 26, 27, 28, 29 read 22, 23, 24, 25 respectively.*
- p. 97, line 16, *for generate read develop.*
- p. 110, lines 16 and 17 should appear under line 11.
- p. 128, line 7 from bottom, *for GERARDI read GIRARD.*
- p. 185, *for of Vichy water read in Vichy.*
- p. 260, line 17 from bottom, *for January read August.*
- p. 279, line 6, *for to 7° read 7°.*
- p. 279, line 7, *for to 5.5° read 5.5°.*
- p. 279, line 18, *for BOLLENGER read BALLENGER.*

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## PART ONE - ULTRASONIC WAVES





## DIVISION I - GENERAL ASPECTS

### CHAPTER 1

### HISTORY

A study of the history of sound waves reveals that as early as 1793 mention was made of the results of an explosion in Landau; 92 newborn infants died from the effects of the sound waves and several others became cretins. About the same year very big fish were found dead in the water along the banks of rivers, as a result of heavy gunfire. These disastrous consequences must mainly be attributed to the audible sounds, but possibly also to the accompanying infratones.

In 1880 GALTON and REMAGEN experimented in their laboratory and constructed the well-known Galton whistle.

It is reported that even in the Middle Ages sound waves were used for therapeutic purposes. A big organ was provided with a glass sound-board. Patients placed on this sound-board were subjected to the vibrations. These curative efforts were mainly made with respect to mental patients. This organ sound-board therapy must be considered as rather dangerous, as the facts described above demonstrate that audible sound waves may have such a strong influence on living tissues that death follows exposure to them.

After the tragic fate of the Titanic in 1912 had caused agitation throughout the world, means of warning ships of the presence of obstacles on their route were sought for. It appeared that ultrasonic waves were highly suitable for this purpose, as they are well transmitted through water. When shortly afterwards the first world war broke out, ultrasonic waves were used as signals. In 1915 CHELOWSKY demonstrated an electrovibrator for the French government; it looked like the receiver