

AN OLD VOLUME BRINGS A NEW INSIGHT IN THE HISTORY OF PHYSIOTHERAPY AND MEDICAL EQUIPMENT IN THE 1920s IN ROMANIA

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Abstract. A forgotten treatise published in 1929 proves to be, when analyzed in the historical context, a volume that might be the first in Romania to attempt an original and comprehensive exposition of modern physiotherapy and to deal with, in a significant manner, with the related bio-physics topics. The volume is largely representative for the domain at an international level and has distinctive traits of originality. Subsidiary, the volume provides a reflected insight on the bio-medical equipment of the time.

Key words: history of science, medical physics, physiotherapy.

1. PRELIMINARIES

The “Treatise of Physio-Dynamics” (Tratat de Fizio-Dinamie), vol. I, authored by Dr. Petre Niculescu, appeared at the publisher Editura Casei Școalelor, Bucharest, in 1929 [1]. The copy presented here comes from the library of the Romanian Academy House in Gălănești, near Rădăuți town. Its provenience is from the library of the Romanian Academy, as two rubber stamp imprints show. I report here on the first volume of the treatise because I did not find the second one.

The copy I read has on the cover the signature of “Dr. Hurmuzache”, (see Fig. 1). Supposedly, the signature is of the late professor at the University of Medicine and Pharmacy of Iași, but a relative of him is also a possibility. Perhaps, the volume first belonged to Dr. Hurmuzache and was sold through an antiquary from Iași to the Academy, because the on the 3rd cover the volume it has a stamp “Anticariat Iași / Lei 38” (Antiquary of Iași).

The volume deserves a retrospective presentation because it represents an attempt to propose new concepts, even a new sub-domain, “physio-dynamics”, in medical science. Its limits and its publication in the Romanian language only made this attempt fruitless; however, from the historical perspective it is important for the national medicine and the international history of the physiotherapy because of its originality and the question it raises on the underlying mechanisms of physiotherapy – a question still only partly answered. From this perspective, it exemplifies the relationship between the technology development, the level of knowledge in medicine, and the successes and perils of physiotherapeutic practice. Moreover, the volume is important because it is published at an epoch when oncology was only embryonic, physiotherapy was basically restricted to classical methods like balneology,

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and electronic equipment was still rudimentary. The volume reflects the process of emergence of new disciplines like therapeutic in oncology and electrotherapy, backed on the knowledge in older ones, like balneal physiotherapy.

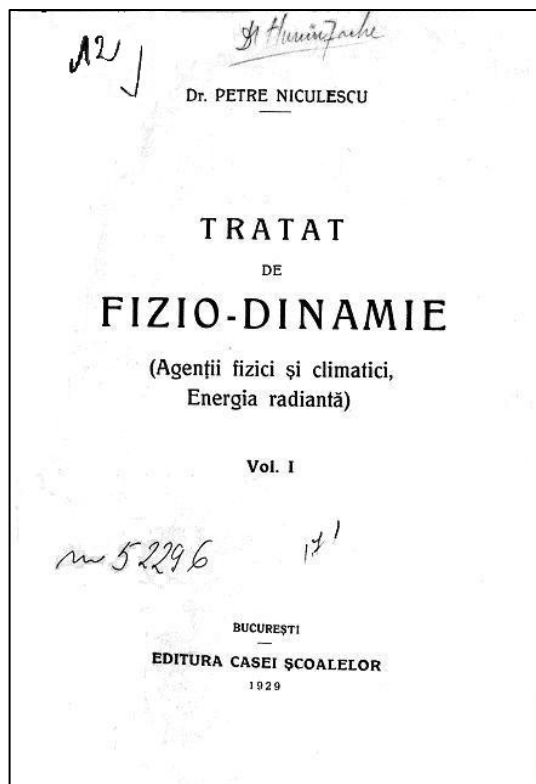


Fig. 1. The sub-cover of the volume. Photocopy, shading removed (see the methodological note at the end of the paper).

The publication of this book at the epoch is not a surprise, because the physiotherapy was already firmly established in Romania [2], [3] as a medical field, due to Anibal Theohari, the initiator of the (Romanian) Society of Medical Hydrology and Climatology (established in Bucharest in 1922) and of the Journal of Medical Hydrology and Climatology (established in 1924) [4], [5]. The Institute of Balneology was operating in Bucharest since 1924 also under the directorship of Theohari. Moreover, the Fifth International Congress of Thalassic Therapy was held in 1928 in Romania (Constantza), attracting the attention of the medical society as well as the attention of the public. The publication of a new book in the field in Romania at that time was natural – Theohari had already published several volumes of his five-volume treatise on the topic, written during 1922 and 1931. Niculescu might have been one of the students of Theohari, but he does not mention Theohari in the Preface of his volume. Anyway, by publishing his book, Niculescu was directly competing on the scientific scene with Theohari. Yet, the

competition was rather between older and newer domains in physiotherapy, as Theohari was mainly interested in balneology, while Niculescu promotes in the first place electric methods and methods based on X-rays and nuclear radiation.

In the national context, the book appears under favorable circumstances, as the literature of physiotherapy was ample and well illustrated by volumes published in France on the opportunities of balneal treatment in Romania and due to contributions of Saabner-Tuduri [6].

2. GENERAL PRESENTATION AND DISCUSSION OF THE VOLUME

The volume, which extends on 216 pages, is divided into four sections named "Electricity", "Chemical Agents", "Climatic Agents", and "Radiant energy (Bases of Roentgen and Radium)" (sic), see Fig. 2. A brief introduction complements the volume.

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Fig. 2. The first page of the Table of Contents. Photocopy, basic image processing applied.

The title of the book is unusual both for our days and for the days of its publication. The needed explanation is provided by the author at the beginning of the "Introduction":

“Physio-dynamics constitutes a new denomination that must be explained. This explanation legitimates the need for this treatise as well as its original note. The standing progress of Physiotherapy, so much increasing during the last two decades, in the first place by the bright curative results obtained by the Roentgen Radiation and the Radium, was document in numerous treaties. The treatise I present is significantly different from the ones published until now because of the principles it promotes. By Physio-dynamics I understand the acting manner of the physical agents, exposed according to the methods used in the Pharmacodynamics, which studies the intimate mechanism and the charges produced by the medicament”. [Translated from Romanian].

For the Romanian version of the above fragment, see the photocopy in Fig. 3.

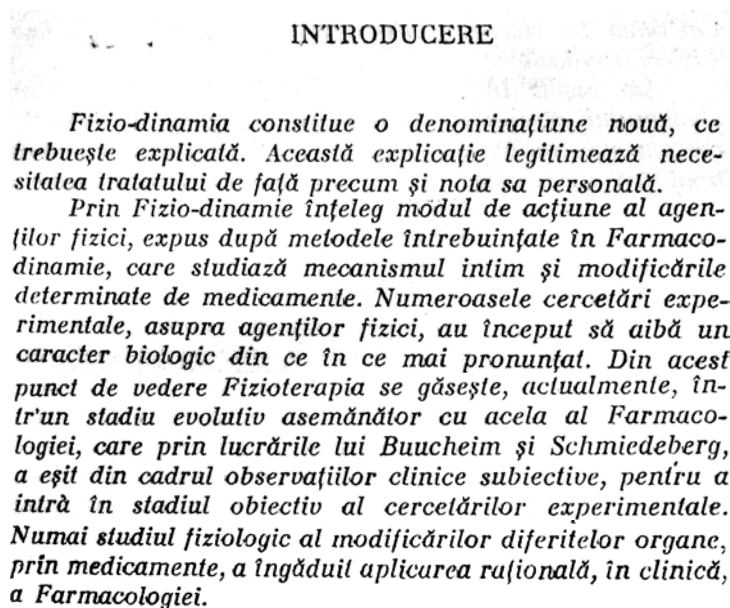


Fig. 3. Segments from the first page of the *Introduction* of the volume. Segments of photocopy, basic image processing applied.

The title of the volume is also unusual because it is misleading and confusing: the author's intent was to argue for, introduce, lay out the foundations, and explain a new domain, that of the dynamic processes in physiotherapy. However, the title would rather mean the dynamics of the physiology or that of the physiological processes.

The importance of the volume is twofold: it is an original treatise, attempting to give the reader a synthesis on the biological effects produced by the physical factors used in therapy in order to explain the therapeutic effects and the author tries to introduce a new domain that the author names “physio-dynamics”, in a parallel proposed with the pharmacodynamics. The idea of the parallel between pharmacodynamics and physiodynamics may have originated from the interests of Professor Theohari, who was at that time the undisputable leader in physiotherapy

in Romania at that time, moreover had a strong interest in biochemistry. While the idea may have been only partly due to Niculescu, he however has the merit of applying it systematically to the new fields of electro-therapeutics and to radiation treatment, beyond the balneal treatment of interest for Theohari and the mainstream of Romanian physiotherapy.

The nature of the approach is explained by the author in the "Introduction":

"In writing this treatise, ... I gave up exposing the techniques of application of the physical agents ... which belongs to the specialist doctor. Also, I gave up the description of the physical agents, a description that belongs to the Medical Physics.

Instead, I extensively exposed the notions needed by the student and by the practicing doctor, for the understanding of the intimate mechanism of the physical agents, the anatomical and physiological modifications they produce, together with their indications, counter indications and accidents." (Translated from Romanian.)

The effort to propose and provide content to a new concept is a brave but risky one – in fact, the author only partly succeeds to convince us about the new domain he promotes. The concept proposed is an integrative one and requires not only insight, but a large horizontal, inter-domains investigation and demonstration coverage. The author only partly convinces us that he has the needed knowledge to produce the demonstration. In the two main topics covered, electro-therapy and radiation therapy, while he quotes many European authors on various somewhat disparate therapy cases, he fails in the task of providing a synthetic view on the topic for justifying the core subject, "physio-dynamics".

The field of radiation, particularly X-ray treatment is of special local importance because in the X-ray medicine and technology research of the Romanian school had an initial good start – in fact, it was one of the few domains where Romanian science excelled in the late 1880s and brought a significant contribution to the international science and technology scenery. The treatise was published about four decades after the contributions of Dragomir Hurmuzescu and Gheorghe Marinescu to X-ray physics [7], equipment and medicine. The analysis of the volume shows that an atypical successful start in a peripheral European country, like the one mentioned, was not enough for a successful standing development of the domain if the economy and politics were not helping, and the management entrepreneurship spirit was immature.

Probably the most surprising today is the precarious level of knowledge at that time of the effects of nuclear radiation. Treatments with nuclear radiation – either X-rays or nuclear radiation of isotopes – were attempted for all medical conditions, without the understanding of the perils. While several mechanisms were proposed for the action of the nuclear radiation on the cell (pages 133–156) and various forms of cellular mutations are reported (pages 142–144), the lack of knowledge regarding the functions of the cellular nucleus prevented a correct understanding³. On the other hand,

³ The then theory was vague: "Under the hypothesis of Wassermann, the cell is composed of two parts, the *nutriceptors* and the *genoceptors*, ... the *genoceptors* are composed of the elements needed for the cell reproduction" (p. 143).

the use of electrical stimulation was quite advanced, although electronic equipment was yet rudimentary and unreliable. It was already known, for example, that “The treatment of bone fractures by Faradic currents, introduced by Apostoli and Delherm, prevents, in the first place, the muscular atrophy” (p. 25).

Also of interest is the level of knowledge at that time on the electrotherapy. In section 3 of the first part, *Electricity*, titled *Faradic Current (Curentul faradic* in Romanian) [pages 17–18], the author provides the explanations:

“*Neuro-muscular action.* The Faradic current, also named interrupted current, is constituted of a fast succession of waves of alternate sign, of opening and closing form... More the interruptions are frequent, more the contractions generated by them are frequent. A number of 10 to 15 interruptions per second determine clonic contractions, ... from 80 to 120 per second, the so-called tremor contractions, ... extremely fast, between 2000 and 3000 per second produce sub-entrant contractions, which determine a true tetanization...” (Our translation.)

“*Acțiunea neuro-musculară.* Curentul faradic, sau întrerupt, este constituit dintr-o succesiune de unde de sens contrariu de închidere și de deschidere. Cu cât întreruperile sunt mai dese, cu atât contracțiunile provocate sunt mai frecvente. Un număr de 10 până la 15 întreruperi pe secundă, determină contracțiuni clonice, ... de la 80 până la 120 pe secundă, așa numita contracțiune tremulantă, ... extrem de dese între 2000–3000 pe secundă produc contracțiuni sub-intrante, ce determină o adevărată tetanizare. ... Tetanizarea faradică, spre deosebire de tremulația faradică, este vătămătoare, determinând o atrofie musculară.”

A photocopy of the first page of the section “Electricity” is shown in Fig. 4.

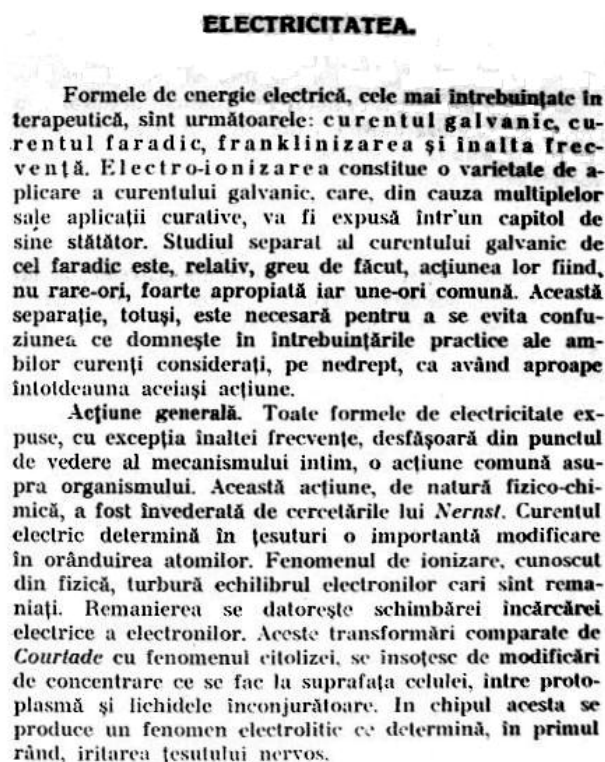


Fig. 4. Photocopy of the first page of the section “Electricity”. Photocopy, basic image processing applied.

Among the limits of the volume, one is especially striking, namely the lack of any consistent reference to the electro-physiology of the heart and the interference of the heart electrical activity with the treatments using current. While the author provides some general and simple ideas on the detrimental effects on the heart activity induced by treatments with electrical currents, the insight is limited. We know that the electrocardiography (EKG) was demonstrated in 1893 by Einthoven, who refines the technique until 1905, almost 25 years prior to the book by Niculescu, moreover we know that by 1930, all the major facts related to heart electrophysiology, as possible to determine with surface electrodes EKG, were already discovered – see Introduction, p. XIV, [8]⁴. The author of the discussed volume seems not knowledgeable on these recent (at that time) advances.

Niculescu gave a large extent to the section devoted to the treatment using X-rays and radionuclides. He is well documented on the topic and does not hesitate to enter disputes and to promote a personal point of view, disputing established theories. An example is constituted by his correct interpretation of the delay in the effect of the radiation. At page 146, arguing against the views of Lacassagne and Monod and bringing in the support of the studies due to Lubarasch and Wätjen that he cites, Niculescu introduces a new and more appropriate definition of latency of the effect of the radiation, saying:

“We will consider, therefor that the latency is the time needed for the evolution of the physico-chemical alterations [of the cell] that, going through the histological transformations, arrive at the final study of anatomic modifications [of the cell].”

rior. Vom considera, deci, latența ca fiind timpul necesar evoluției turburărilor fizico-chimice cari, trecând prin etapa modificărilor histologice, ajung la stadiul final al alterațiilor anatomic. După această concepție timpul de latență nu este fără de analogie cu timpul de incubare necesar dezvoltării infecțiilor.

Fig. 5. Segment from page 146, about the delay in the effect of radiation. Photocopy, basic image processing applied.

To determine the level of the treatment provided by Niculescu on the radiotherapy, we must refer to the existing knowledge in the late 1920s. The radiotherapy developed almost immediately after the discovery of X rays and nuclear radiation from radium, in 1896, both in Europe and in USA – see for example the brief review of the book “X-Ray Treatment – Its Origin, Birth and Early History”, by Emil H. Grubbe, The Bruce Publishing Co, St. Paul, 1949 in [9]. In USA, General Electric developed and commercialized by 1915 X-ray tubes at 140 kV anodic voltage and by 1922 tubes at 200 kV for deep treatment of tumors. The X-equipment market was already significant before WWI, as about 300 radiologists

⁴ Dangman and Miura, 1991, [8], say “By the late 1920s, many of the insights that could be obtained using simple surface electrocardiograms ... had been obtained.”

activated by then in US alone, and tripled by the end of the 1920s – with about 1000 radiologists in US [10, 11].

The volume provides a glimpse on the level of the technology at the time, in particular on the incredibly low reliability and low degree of protection the equipment ensured. For example, at page 46, the author mentions: “For the side of the person that uses the apparatus, it was reported a mortal case (a doctor from Vienna) through electrocution, appeared under unknown conditions”. The accident is related to equipment for diathermy.

The very low reliability of the equipment of the time and the incredible low level of protection it ensured result from several accidents described by the author. For example, at page 27, he writes about a non-fatal accident at 100 kV⁵:

“The passing through the human organism of a high frequency current, at a very high voltage (more than 100000 Volts in the case of a doctor who received the discharge of the transformer of Roentgen equipment) is supported without any marked trouble.” (sic), [Chapter 4, High frequency, (D’Arsonvalisation), Part I, Electricity].

Also, at page 12 (Chapter 1, The Galvanic Current, Part I, Electricity), the author remarks, emphasizing the role of the technological development of the time, that

“The generalization of the use of electricity in the industry, moreover the Roentgen equipments through the high voltage transformers produce, quite often, fatal accidents, therefore the need of knowing the mechanism of these accidents.”

From the historic point of view, this book proves that the Romanian medicine of that time was using essentially all the technical means known by the epoch in physiotherapy and had, in this field at the crossroad of physics, medicine, and engineering, the development level allowing the specialists to pursue original research and original scientific and educational syntheses.

According to the tendencies of the epoch when the volume was written, a large emphasis is given to the treatment with X- and nuclear-radiation: “I have studied the effects of the Roentgen rays and of the Radium ... in a chapter ... Radiant Energy ...”. While at that time the knowledge on the dangers of applying such a treatment were only partly known, the author however insisted that “... the accident can be, sometime, extremely grave, especially in radio-therapy”. The fourth part, *Radiant Energy*, occupies almost one third of the book.

It is worth noting that the quoted authors are mainly French, German, Austrian, and Italian. This shows that the Anglo-Saxon medical literature was of little significance at the time as a source for the Romanian medicine in the 1920s⁶.

⁵ We know that this level of voltage was used at that time in X-ray equipment; for example, in the X-ray tube manufactured by General Electric, the so-called General Electric “Universal” X-ray Tube (ca. 1920s), the anodic voltage was indeed 100 kV, see. <http://www.orau.org/ptp/collection/xraytubescoolidge/coolidge.htm>, Last updated: Copyright 1999, Oak Ridge Associated Universities. Accessed Sept. 10, 2009

3. CONCLUSIONS

The volume represents a respectable, yet short lived attempt of original contribution, thoroughly documented and up-to-date for the time. Niculescu represents the “new trend” of the time in physiotherapeutics, a trend which was oriented toward new technical means, to electro-therapy and to radiation therapy. However, this trend has not significantly succeeded in the traditional-oriented culture and medicine of Romania at that time, where balneal therapy had strong roots and was emphasized in the detriment of new techniques. Nevertheless, the role of the volume can not be neglected from a historical perspective because of the impetus it may have given to electro-therapy and to oncological research and radiation treatment in Romania in the 1930s.

The volume by Niculescu provides an understanding of the level attained in the 1920's by the (technical) equipment for physiotherapy and by the physiotherapy itself. Besides reflecting the national level of development in the field, the book provides a view of the international or at least European level of both equipment used in the physiotherapeutic treatment and physiotherapy. Hence, the utility of its reporting in the general context of the history of science is significant for the national and European history of science.

ACKNOWLEDGMENTS. For writing this paper I used an opportunity provided by the Romanian Academy to stay in the Gălănești Academy House for four days and study some of the rare books deposited there. Mr. H.M. Teodorescu helped with photographs.

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⁶ For example, although Niculescu deals with the effect of radiation on sperm and ovules, he does not cite significant papers in the American literature, as W.M. Baldwin, Effects produced by X-ray Energy acting upon Frogs' Ova at Early Developmental Stages, p. 229–230, *Science*, 52 (1340), Friday, September 3, 1920, or the volume on X-ray surgery by R.P. Kincheloe and A.G. Drury, X-Ray Operation, pp. 121, with illustrations. Cincinnati: X-Ray Consulting Bureau, 1920.

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Methodological note. The photocopies included in this paper were taken with a digital camera. For each image, the portion deemed of interest was digitally sectioned and, whenever needed, it was rotated to be in a right position.



On Fig. 2, the noise and shades were removed digitally around the text, without affecting the noise inside the text lines (e.g., around the characters). Contrast and illumination adjustments were applied for improving the printing quality. No other image processing method was applied and no alteration was produced to the photocopies of the text, except for Figure 1, which is reproduced unprocessed below. Therefore, the photocopies can be considered genuine according to today standards of graphical documentation of the historical artifacts.

Pre-publication note. Two preliminary, abbreviated versions of this paper appeared as “A note on an early Romanian book on physiotherapy – the treatise of physio-dynamics, by Petre Niculescu, 1929”, in *Jurnal Medical Brașovean*, nr. 2 / 2009, pp. 73–75 abstract at <http://www.unitbv.ro/faculties/medicina/JMB/09%20revista%202.htm> and on a CD distributed to the participants at X-a Conferința națională de inginerie biomedicală – 2009, 12–14 nov. 2009, București. This paper represents the definitive version of the work.

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