

## The need and possibility of teaching clinical neurophysiology at faculties of physiotherapy

### Potrzeba i możliwość nauczania neurofizjologii klinicznej studentów fizjoterapii

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#### Key words

undergraduate education, clinical neurophysiology, physiotherapy

#### Abstract

**Introduction:** Although fundamental issues of clinical neurophysiology constitute a part of standard education of students at physiotherapy faculties, the graduates from these faculties do not associate their professional and/or scientific career with this category of clinical diagnostic studies. These diagnostic tools, however, are very important for neurorehabilitation. Thus, students are not trained by professional clinical neurophysiologists. Problems related to clinical neurophysiology are implemented in different study and training contents that disintegrate transfer of knowledge and are harmful for the rank of clinical neurophysiology in the environment of physiotherapists.

**Aim of the study:** To show that, in conformance with the standards of physiotherapy education, there is a need to teach clinical neurophysiology as a separate subject and that there are possibilities to reliably utilise the existing infrastructural and financial potential to introduce the lectures and practical training of clinical neurophysiology into the physiotherapy faculties curricula.

**Study form:** to perform an initial assessment to estimate: 1. which issues of clinical neurophysiology are implemented in core standards of education of the physiotherapy faculty students; 2. in which and how many of the country districts medical or physical education universities and other public or private high schools have faculties of physiotherapy; 3. in which districts, bordered territorially by these schools, there are establishments licensed to conduct training in clinical neurophysiology; 4. what type of scientific status do persons certified in clinical neurophysiology have, who are listed in the districts with physiotherapy faculties. 5. how many persons among physicians and physical culture teachers receive scientific degrees for research in clinical neurophysiology associated with rehabilitation and physiotherapy.

**Conclusions:** There is a need, infrastructure and financial support to include clinical neurophysiology into the curricula of the physiotherapy undergraduate education.

#### Słowa kluczowe

edukacja przeddyplomowa, neurofizjologia kliniczna, fizjoterapia

#### Streszczenie

**Wstęp:** Aczkolwiek treści kształcenia z zakresu przedmiotu neurofizjologii klinicznej należą do standardów studiów I i II stopnia na kierunku fizjoterapii, absolwenci studiów fizjoterapii nie wiążą swojej kariery zawodowej i naukowej z tą, ważną dla neurorehabilitacji, dziedziną diagnostyki klinicznej. Studenci nie są nauczeni neurofizjologii klinicznej jako dziedziny diagnostyki medycznej, ale poznają jej fragmenty włączone do innych przedmiotów nauczania. Taka dezintegracja przekazu wiedzy obniża rangę tego przedmiotu i szkodzi jego reputacji w środowisku fizjoterapeutów.

**Cel pracy:** Wykazanie, że zgodnie z obowiązującymi standardami edukacji fizjoterapeutów istnieje potrzeba nauczania neurofizjologii klinicznej jako wyodrębnionego przedmiotu, oraz że są możliwości wykorzystania istniejącej infrastruktury i środków finansowych dla zrealizowania takiej innowacji.

**Projekt pracy:** Dokonanie wstępnych ocen dla ustalenia: 1) jakie z treści kształcenia dotyczące neurofizjologii klinicznej są włączone do treści kształcenia innych przedmiotów nauczania; 2) w ilu i w których województwach są rozmieszczone wydziały fizjoterapii akademii medycznych i wychowania fizycznego oraz innych szkół wyższych publicznych i niepublicznych; 3) w których województwach, związanych terytorialnie z tymi szkołami wyższymi, są rozmieszczone placówki uprawnione do prowadzenia szkoleń w zakresie neurofizjologii klinicznej; 4) jaki jest status naukowy certyfikowanych w zakresie neurofizjologii klinicznej osób, które są ewidencjonowane w województwach, gdzie są prowadzone studia fizjoterapii; 5) ilu spośród lekarzy i nauczycieli WF uzyskuje stopnie naukowe za związane z rehabilitacją i fizjoterapią, prace naukowe z neurofizjologii klinicznej.

**Wnioski:** Istnieje potrzeba, infrastruktura i są możliwości finansowe dla wyodrębnienia neurofizjologii klinicznej w programie nauczania studiujących na kierunku fizjoterapia.

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## Introduction

The development of bioengineering and the dissemination during the years of the Decade of the Brain (01.01.1990-31.12.2000) of apparatus (instrument) research in the field of clinical neurophysiology (CNP) enabled a verification of hypotheses on the regeneration and the plasticity of the structures and functions of man's central and peripheral nervous system. This has advanced and maintained clinical neurohabilitation<sup>A</sup> at the fore of other fields of medical rehabilitation, independent of changes in the concept of man's health. The World Health Organisation established in 2001 the International Classification of Functioning, Disability and Health (ICF) and adopted (2005) a resolution on the prevention, treatment and rehabilitation of disabled individuals<sup>1,2</sup>. This initiated a process for the standardization of the conceptual model of physical and medical rehabilitation as a health strategy<sup>3,4</sup>. In this model, and particularly in relation to an individual with central and peripheral nervous system damage, physiotherapy constitutes a key link in which the physiotherapist plays a key role. The physiotherapist employs physical procedures with the aim of improving the incorrect or reinforcement of residual nerve control, the function of standing, involuntary movements and locomotion through the utilisation of the physiological phenomenon of the reaction of the nervous system to physical stimuli. The task of a physiotherapy specialist is the utilisation of the energy from these stimuli with three aims, i.e. the recognition of the causes of neurodysfunction, treatment in accordance with the EBM requirements and the evaluation of the effects of the chosen method of conduct. The EBM requirements fulfil CNP which is a field of medical diagnostics of central and peripheral nervous system damage, covering various categories of electro-neurodiagnostic research (Table 1). CNP research is professionally conducted by medical employees with tertiary or secondary education in possession of an appropriate certificate (license) obtained

after training in one of the centres accredited by the Polish Association of Clinical Neurophysiology (PTNK). Only medical doctors may try for a EMG licence covering also ENG, while in the case of EEG and EP licences equally medical doctors though in justified cases also psychologists and biologists. Those who have been a member of the Technicians' Section of PTNK for at least two years may try for EMG and EP<sup>5</sup>. Doctors of neurology, neurosurgeons, orthopaedists, otolaryngologists, psychiatrists and dental surgeons possessing the title of specialist or 2<sup>nd</sup> degree specialisation in the field of medical rehabilitation following training organised by the Centre for Medical Post-Diploma Education may try for a certificate of competency allowing them to provide CNP services. Other doctors may equally try to obtain such a certificate but only after attending training sessions rooted in a specialist programme with an extended range of clinical internships and theoretical courses<sup>6</sup>. In the light of the above legal directives, a graduate of a faculty of physiotherapy can not try for a PTNK certificate or a CMPK diploma despite interest in the field of CNP during the course of their studies. This appears only, however, at institutions of HE where the subject is separated in the teaching programme and the lectures and practical classes are conducted by qualified and competent teachers.

In the 2004/2005 academic year there was conducted amongst 132 students of physiotherapy at two medical academies an anonymous survey evaluating (on a scale of 0-6) the comprehensibility and usefulness of lectures and practical classes in CNP. In one institution<sup>B</sup> from amongst the general number of 23 taught subjects, the subject of CNP came in 5<sup>th</sup> place (lectures) and 6<sup>th</sup> (practical classes). The values of average marks were for comprehensibility 4.52 (lectures) and 4.54 (practical classes), while for usefulness – 4.19 (lectures) and 4.23 (practical classes). In the second institution<sup>C</sup> the average marks for comprehensibility were 2.85 (lectures) and

2.93 (practical classes), while for usefulness – 2.87 (lectures) and 3.0 (practical classes). At the same time a population (2006) of MScs (5) BScs (4) and physiotherapy technicians (42) employed at 8 treatment rehabilitation clinics was surveyed. It turned out that none of those surveyed undertook tests in classic electrodiagnosis and that doctors did not send patients for such tests<sup>7</sup>.

The undervaluation of CNP amongst doctors and physiotherapists results from its marginalization during the course of pre-diploma education. A student of physiotherapy does not acquire conviction as to the significance of CNP as a result of improper conditions for the realization of the content of education in this field. Knowledge about CNP is conveyed by various teachers unqualified in this diagnosis within the framework of various taught subjects. This lessens the ranking of CNP as a field for doctoral studies in physiotherapist circles.

The reason why the knowledge on CNP amassed, delivered and described since the 1950s is not used by physiotherapists in cognitive goals in a comparable way to doctors, psychologists and biologists is a puzzle. There is an absence of information as to what degree CNP research was used for the physiotherapy needs of neurological patients for the years 2005 and 2006, when the number of physiotherapists was 10,000 and the number of specialist doctors in physical medicine and rehabilitation, 900<sup>16,17</sup>. Around<sup>E</sup> 76 neurophysiological specialists, 332 possessing EEG licences, 81 in EMG and 23 in EP could have undertaken such research in this area.

Current events, like the subject matter of the Second Educational Congress in Physiotherapy<sup>18</sup> organised by the European Region of the World Confederation of Physiotherapy, taking place in many countries are the tendencies for a redefinition of the role of a physiotherapy specialist<sup>19</sup>, and particularly the model realised for the education of specialists of physical medicine and rehabilitation in the

A physiotherapy of the neurologic patient during hospitalization

B lectures and classes taught by a physician specialist of rehabilitation medicine with a CNP licence

C lectures and classes taught by a neurologist

D according to an undated list of persons possessing a PTNK licence

**Table 1**

<b>Categories of electrodiagnostic tests (selected from CNP)</b>	
Classical Electrodiagnosis	Rheobase chronaxis curve i/t accommodative coefficient
Electroencephalography (EEG)	primary activity activated activity
Electromyography (EMG)	basic study <sup>a</sup> global study <sup>b</sup> polyelectromyography <sup>c</sup>
Electroneurography (ENG)	nerve conductivity <sup>d</sup> muscle reflex <sup>e</sup> nerve-muscle transmission <sup>f</sup> parasympathetic skin response <sup>g</sup>
Invoked Potential (IP)	exogene <sup>h</sup> endogene <sup>i</sup> motor <sup>r</sup>
Special tests	
<sup>a</sup> tests with needle electrodes; <sup>b</sup> tests with surface electrodes; <sup>c</sup> test of many muscles with surface electrodes; <sup>d</sup> motor and sensory nerves; <sup>e</sup> monosynaptic and polysynaptic; <sup>f</sup> so-called myasthenic trial; <sup>g</sup> testing the exciteability of the sympathetic nerve system (so-called 'lie detector'); <sup>h</sup> somatosensory; dermatomal; visual; auditory; <sup>i</sup> thought processes not connected with an external stimulus but with an event: P300; contingent negative variation CNV; readiness potential; <sup>j</sup> induced by through-cranial brain magnetic stimulation and through-skin peripheral nerves magnetic stimulation	

area of electrodiagnostic medicine<sup>20</sup>, should be conducive to undertake initiatives in Poland which would lead to innovations within the standards of 1<sup>st</sup> and 2<sup>nd</sup> degree on physiotherapist courses through the introduction of CNP as a subject for teaching, the creation of legal regulations, the utilisation of the existing infrastructure and financial resources from European Union funds.

### The need for the teaching of clinical neurophysiology

In 1989 Paul Bach-Y-Rita<sup>21</sup> claimed that the fundamental barriers in the development of neurorehabilitation is the lack of a scientific tradition and an understanding of the necessity for the creation of theory for this area of medicine. He pointed to the need to search for answers to key questions: what is the role of neurotransmitters in the treating of central and peripheral nervous system damage, whether the mechanism of reorganisation and/all regeneration is modified through the procedures based on EBM that are applied, and how motivation, environment and family translate into the neuromechanisms of functional regeneration. For from the defining of the biological basis of physiotherapeutic effectiveness will be con-

ditioned by the principle of cost-effectiveness that is always observed by the insurer.

The scientific academic basis of both physiotherapy and CNP tests conducted on patients with central and peripheral nervous system damage is biophysics and the paradigm of the quantitative description of neurophysiological phenomena. In units of the *Système International d'Unites* – SI there is controlled and measured the effects of activities on the organism of energies from various physical and chemical stimuli. Both the energy of stimuli activating receptors as the energy released by activated neurons changes within the nervous system into its own energy of bioelectrical impulses. The energy of these impulses is received, processed, strengthened registered and depicted by technical instruments in the form of bioelectrical potentials measured automatically in SI units.

In Polish state and private institutions of higher education as of the 1<sup>st</sup> of October 2007, education in faculties of physiotherapy encompassing day and extramural courses of the first and second degree are conducted according to the standards for education as covered by the European Area for Tertiary Education<sup>22</sup>. In accordance with these standards a

graduate from a faculty of physiotherapy should have knowledge and practical abilities in the conducting of CNP tests for a patient with central and peripheral nervous system damage. The achievement of the abilities and skills to conduct such diagnostic procedures involves the application of the content of the education received during the first and second degrees of study. In relation to the first degree the teaching of the theory and practice of CNP is exclusively in the content of physiology teaching (the group of rudimentary content) as well as physical therapy, general physiotherapy, clinical physiotherapy and the clinical physiotherapy of dysfunctions in the organs of locomotion (the group of specialised content). In relation to the second degree, the teaching of the theory of CNP practice is incorporated within the content of instruction from the methodology of tests (the rudimentary content group) as well as physical medicine and balneoclimatology and functional diagnosis (the specialised content group). There is required the allocation of at least 75% of the hours given for the teaching of content through clinical practical exercise classes (Table 2). This is in accordance with the fundamental principle of education<sup>23</sup>. However, the programme does not specify the necessity for practical CNP classes and in terms of the educational content this is conveyed by various academic teachers from a range of varied academic disciplines. The lack of practical classes and the disintegration of CNP knowledge transfer results in the student being unable to understand its significance for the physiotherapy needs of a patient with central and peripheral nervous system damage. As a consequence a student is unable to become interested in taking up a specialisation of a PhD programme in this field.

A physiotherapist who wishes to objectivise the function of a damaged central and peripheral nervous system in a neurological patient can refer him to CNP tests, for example to a neurologist. The knowledge in the field of CNP required from a neurologist touches, however, chiefly the interpretation of results and not practical abilities in the conducting of EEG, EMG, ENG or EP tests. Such

**Table 2****Core standards of undergraduate physiotherapy courses pertaining to clinical neurophysiology in educational programmes of various rudimentary and specialised subjects of the 1<sup>st</sup> and 2<sup>nd</sup> degree at faculties of physiotherapy\***

1 <sup>st</sup> Degree			2 <sup>nd</sup> Degree	
Divisions Core standards and other re- quirements	Education in	Concerns clinical neurophysiology	Education in	Concerns clinical neurophysiology
Rudimentary content group	Physiology	Fundamentals of neurophysiology. Central and peripheral nervous system. Muscles as well as: the types of fibres; neuromuscular junctions; recruitment of motor units; conductivity and excitability of nerve fibres; electric action of muscles; reflexes, controlling of movements; plasticity of the nervous system and muscles; reinnervation; neurophysiology of pain	Testing methods	Reliability, reproducibility, verification, registration and norms of test results; quantitative methods; problem of quantifying the test results in rehabilitation and physiotherapy; current test possibilities in physiotherapy.
Specialist content group	Physical therapy General physiotherapy Clinical physiotherapy Clinical physiotherapy in the dysfunction of movement	Electrodiagnosis – qualitative and quantitative methods Suitability and significance of various apparatus tests Conducting of functional tests in neurology Undertaking of tests essential for the selection of physiotherapy means for the physiotherapy of neurological patients with movement dysfunctions	Physical medicine and the balneoclimatology; functional diagnostic methods	Physical diagnostic methods useful in physiotherapeutic practice. Abilities and competencies in the selection of diagnostic testing for the verification and modification of the programme of the rehabilitation of individuals with nervous system dysfunctions
Other requirements		At least 75% of teaching hours in the above mentioned content should be realised in the form of clinical practical exercises		At least 75% of teaching hours in the above mentioned content should be realised in the form of clinical practical exercises

\* on the basis of appendix no 33 to the regulation of the Minister of Science and Tertiary Education of the 1<sup>st</sup> October 2007 [www.rgsw.edu.pl](http://www.rgsw.edu.pl)

practical skills are acquired by a doctor during only three 2-3 day specialist courses. These are the courses: EEG (3 days of 6 lecture hours), EMG and ENG (3 days of 6 lecture hours) and EP (2 days of 6 lecture hours). Additionally the abilities in the interpretation of results for these

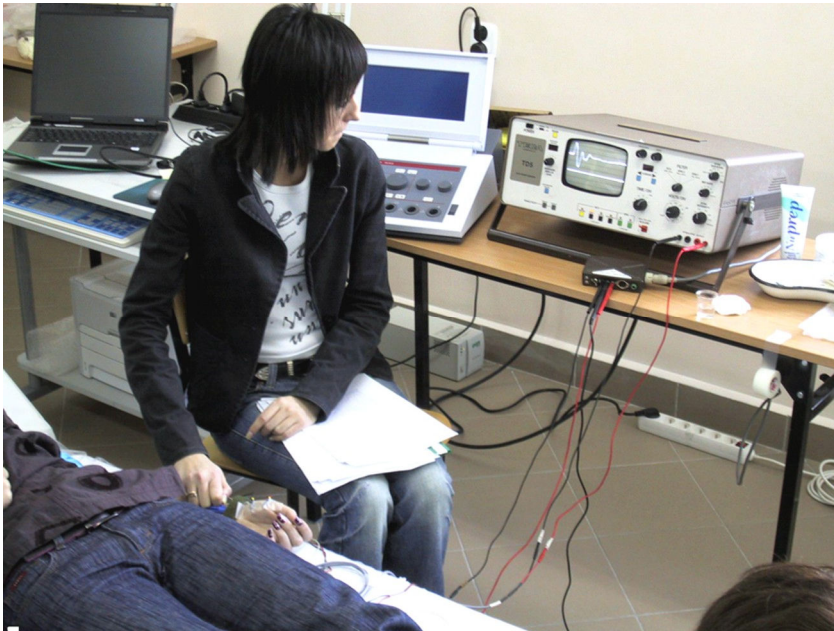
categories of CNP tests can be obtained by the doctor within the framework of a specialising internship in the bases of neurology. The verification of practical skills is confirmation given by those running courses and specialising internships that the doctor has carried out the diag-

nostic procedures independently or has assisted during their realisation<sup>24</sup>. A neurologist responsible for the evaluation of the link between the results of the CNP test and the result of the subject and object test conducted by him is usually, as a result of lack of time, referring the patient himself

**Table 3****MSc and PhD degrees awarded between 17.10.1997 and 24.11.2005 for research connected with neurophysiology in medicine, physical education and medical biology**

Specialization	Area			In total*
	Medicine	Physical education	Medical biology	
Rehabilitation	26 <sup>A, B</sup>	30 <sup>C, D</sup>	8	64
Physiotherapy		17 <sup>E, **</sup>		17
Physiotherapy and rehabilitation		11		11
Rehabilitation and others	7	1		8
Electrophysiology			3	3
Neurophysiology	3			3
Neurophysiology and others	7			7
<b>In total</b>	<b>43</b>	<b>59</b>	<b>11</b>	<b>113**</b>

<sup>A, B, C, D, E</sup> = letters represent one work at the post-doctoral level of habilitacja; other= clinically other, \* = on the basis of data obtained 11.03.2006 from the Centre for Information Processing in Warsaw; \*\* = represents a single doctoral defence on the subject of chronaximeter clinical tests of nerves and muscles.



**Photography 1**

**A student of the University of Cosmetology and Health Care in Białystok during clinical neurophysiology classes (20.02.2006). Examination of the median nerve motor conduction velocity. Transcutaneous electrostimulation of the nerve at the wrist region while observing the amplitude (expressed in mV) of action potential elicited in the muscles of the thenar.**

**Table 4**

**Localisation and number of units licenced to conduct training courses in EEG, EMG, and EP**

No	Provincial administrative division	EEG	EMG	EP	total centres
1	Dolnośląskie (Wrocław)	1	1	1	3
2	Kujawsko-Pomorskie (Bydgoszcz)				
3	Lubelskie (Lublin)	1		1	2
4	Lubuskie (Zielona Góra)				
5	Łódzkie (Łódź)	2			2
6	Małopolskie (Kraków)	2	2		4
7	Mazowieckie (Warszawa)	8	3	5	16
8	Opolskie (Opole)				
9	Podkarpackie (Rzeszów)				
10	Podlaskie (Białystok)				
11	Pomorskie (Gdańsk)			3	3
12	Śląskie (Katowice)	3	1	2	6
13	Świętokrzyskie (Kielce)	1			1
14	Warmińsko-Mazurskie (Olsztyn)				
15	Wielkopolskie (Poznań)	2		1	3
16	Zachodniopomorskie (Szczecin)	1	1		2
	Razem placówek	21	8	13	42

\*/= according to [www.cskwam.mil.pl/ptnk/kursy\\_szk](http://www.cskwam.mil.pl/ptnk/kursy_szk) (20.05.2008)

for CNP tests. However, an individual who does not carry out CNP tests sufficiently often and independently, who is not a clinical neurophysiologist or one having direct contact with one, should not and is not able to interpret appropriately the results of specialist electrodiagnostic tests. In an identical though more difficult situation is the physiotherapist, from whom there is no requirement to carry out CNP tests while studying. Yet a student of physiotherapy who becomes acquainted in practice with the procedure for the conducting of, for example, muscle and nerve excitability, understands the purpose of measurement in SI units of the magnitude of the response of the excited tissue, and is able to interpret the result of the CNP test and to correlate it with the disease symptom (Photography 1).

The consequence of an insufficient promotion of CNP during studies is the small level of interest on the part of HE medical school and PE graduates to obtain academic degrees within this area of specialisation. For the period from 17.10.1997 to the 24.11.2005 113 PhDs were awarded in Poland (including 5 post-doctoral degrees of *habilitacja*) to individuals connected with rehabilitation or physiotherapy, for works in the field of medicine, physical culture and medical biology. In the field of medicine 43 people gained PhDs including 10 for works connected with neurophysiology. While in the area of physical culture, out of 59 individuals only one gained the degree of PhD in classic electrodiagnosis (Table 3). The number of individuals to gain the status of academic employee in the field of CNP coincides with the statistics showing the low level of interest in comparison to the EU average in continual education<sup>25</sup>.

**The possibility of teaching clinical neurophysiology**

The teaching of CNP within the framework of standard education in a physiotherapy degree requires the setting aside of an appropriate number of hours for the running of lectures and practical classes, the employment of appropriately qualified and competent individuals as well as finding sources of finance for the realisation of this aim.

**Table 5**

The academic status of 584 clinical neurophysiologists* evidenced in the district divisions of PTNK** located close to medical academies (AM), academies of physical education (AWF) and other state institutions of HE where a total of 71 classes are at 1 <sup>st</sup> and 2 <sup>nd</sup> degree programme level.														
No	Provincial administrative division	State						Private						
		AM		AWF		IP		INP		All		Total		
		I	II	I	II	I	II	In total	I	II	In total		I	II
1	Dolnośląskie (Wrocław)	1	1	1	1	5	9	4	4	11	2	13		
2	Kujawsko-Pomorskie (Bydgoszcz)	1	1				2	1	1	2	1	3		
3	Lubelskie (Lublin)	1	1			4	1	7	2	1	3	7	3	10
4	Lubuskie (Zielona Góra)													
5	Łódzkie (Łódź)	1				3	4	2	2	6		6		
6	Małopolskie (Kraków)	1		1	1	2	5			4	1	5		
7	Mazowieckie (Warszawa)	1	1	1	1	5	9	4	4	11	2	13		
8	Opolskie (Opole)					2	2			2		2		
9	Podkarpackie (Rzeszów)					1	1	2			1	1	2	
10	Podlaskie (Białystok)	1				1	2	1	1	3		3		
11	Pomorskie (Gdańsk)	1	1	1			3	1	1	3	1	4		
12	Śląskie (Katowice)	1	1	1	1	5	9	16	6	13	2	15		
13	Świętokrzyskie (Kielce)					2	1	3	5	5	7	1	8	
14	Warmińsko-Mazurskie (Olsztyn)					2	1	3	1	1	2	3	2	5
15	Wielkopolskie (Poznań)	1	1	1	1	4	8	2	2	8	2	10		
16	Zachodniopomorskie (Szczecin)	1				2	3			3		3		
	Razem placówek	11	7	6	5	38	4	71	29	2	31	84	18	102

\* / = according to data from institution websites (20.05.2008)

Clinical neurophysiology should become a separate subject for teaching, or hours should be designated for CNP coming from the general number of hours allocated for the content of rudimentary and specialised courses. Such an innovation is possible and in accordance with the adopted (27.11.2007) position of representatives of medical and state and private institutions of HE which run degree courses for 1<sup>st</sup> and 2<sup>nd</sup> degree physiotherapy. The effect of the agreements adopted are the Guidelines of the Department of Science and Tertiary Education and Ministry of Health taking into consideration the possibility of allocating 115 hours of classes, to increase the number of hours of classes defined in the standards of HE education for the first degree of physiotherapy. These hours constitute the difference in hours resulting from the subtraction from the global hour total of 2900 the figure of 1785 hours designated for PE classes (60 hours), foreign languages

(120 hours), IT (30 hours), General Studies (60 hours) as well as for groups with a rudimentary and specialised content (1515 hours). According to the guidelines the above principle should also relate to second degree courses in physiotherapy<sup>26</sup>.

The introduction of the teaching of CNP in schools of HE under the jurisdiction of the Ministry of Science and Tertiary Education that teach in faculties of physiotherapy requires the employment of academic teachers. This is difficult as a result of the relatively low level of pay in the public sector and the phenomenon of holding multiple posts connected with it. In such circumstances it appears justified to search for possibilities of utilising the infrastructure that the existing departments and centres within the field of CNP create. Members of the Polish Association of Clinical Neurophysiology (PTNK) possess the appropriate knowledge and experience as well as practical

skills. These individuals are linked with specialist health care centres equipped with equipment and instruments for the testing of CNP. In the territories of provincial administrative divisions that are the seat of institutions of HE there exist PTNK accredited centres that conduct training in the field of EEG, EMG and IP (Table 4) testing. According to PTNK data there are 21 centres that train for EEG (for children – 9 for adults – 12), EMG – 8 and for IP – 13. These centres are within the territorial range of state and private institutions of HE which run 1<sup>st</sup> and 2<sup>nd</sup> degree studies in physiotherapy (Table 5). In these centres are registered by PTNK individuals of various academic status in possession of certificates entitling them to provide medical treatment in the field of CNP (Table 6). According to the lists compiled by PTNK there are in Poland 76 neurophysiology specialists, 332 with a CNP licence, 81 an EMG and 23 with a IP licence.

**Table 6**

**The academic status of 584 clinical neurophysiologists\* evidenced in the district divisions of PTNK\*\* located close to medical academies (AM), academies of physical education (AWF) and other state institutions of HE where a total of 71 classes are at 1st and 2nd degree programme level.**

No	Provincial administrative division	Clinical neurophysiologists				In total	AM		AWF		IP		In total
		Dr	Dr hab	Prof	Without		I	II	I	II	I	II	
1	Dolnośląskie (Wrocław)	10		2	18	30	1	1	1	1	5	9	
2	Kujawsko-Pomorskie (Bydgoszcz)						1	1				2	
3	Lubelskie (Lublin)	8		2	13	23	1	1			4	1	7
4	Lubuskie (Zielona Góra)												
5	Łódzkie (Łódź)	9	3		29	41	1				3		4
6	Małopolskie (Kraków)	13	3	5	51	72	1		1	1	2		5
7	Mazowieckie (Warszawa)	62	7	24	48	141	1	1	1	1	5		9
8	Opolskie (Opole)										2		2
9	Podkarpackie (Rzeszów)										1	1	2
10	Podlaskie (Białystok)	7	2	1	11	21	1				1		2
11	Pomorskie (Gdańsk)	8		6	47	61	1	1	1				3
12	Śląskie (Katowice)	24	2	10	67	103	1	1	1	1	5		9
13	Świętokrzyskie (Kielce)	3		2	18	23					2	1	3
14	Warmińsko-Mazurskie (Olsztyn)										2	1	3
15	Wielkopolskie (Poznań)	14	3	2	34	53	1	1	1	1	4		8
16	Zachodniopomorskie (Szczecin)	7		2	7	16	1				2		3
	Razem placówek	165	20	56	343	584	11	7	6	5	38	4	71

\* = possessing a PTNK licence in EEG, EMG or EP testing

\*\* = according to www.cskwam.mil.pl/ptnk/kursy\_szk (20.05.2008); \*\*\*= according to data from institution websites (20.05.2008)

Such an infrastructure, existing in 15 of the 16 województwos, may be used by institutions of higher education on the basis of the budget surplus of €4,100,000,000 available to the Ministry of Science and Tertiary Education for realisation in the Operational Programme Human Capital Priority IV Tertiary Education and Science, within the framework of which beneficiaries will be institutions of HE and students<sup>27,28</sup>. A part of this amount may be applied for by institutions of HE on the basis of the guidelines of the Ministry of Regional Development concerning the Operational Programme Human Capital planned for 2007-2013<sup>29</sup>.

### End Piece

The new concept of health strategy and the process for the unification of the conception of a holistic model of bio-psychosocial rehabilitation of

a neurological patient does not accompany the finding of methods of quantitative testing, the result of which would be a comprehensively descriptive integral, various disturbed biological, psychological and social phenomena – domains – of the life of such a person. For this concerns the coincidences of changes in various structures, various organs and systems of the human organism, changes in various cognitive and motor behaviours of man as well as changes in the means of its functioning, in various ontogenetic age, in the changing physical and social environment. There are needed therefore instruments adequately adjusted to tests in each of the above mentioned domains<sup>30</sup>. For as the fundamental domain of health is the state of the biological functions of the human organism, the most useful instrument for the quantitative evaluation of the neurobiological effects of physio-

therapy on a neurological patient (neurophysiatry) is CNP. This field concerns the separation from the holistic conception of neurorehabilitation of its biological aspect and points to one of the routes of enquiry for a scientific theory for neurophysiatry based on biophysics and the quantification of physiological phenomena in SI units. This is confirmed by fact. in accordance with which in the assessment of the effects of treatment of spasticity the most reliable results of tests accredited to the former<sup>1</sup>, turn out to be obtained by means of electrodiagnostic techniques<sup>33</sup>.

### Conclusions

1. There exists a need to introduce to a standard pre-diploma programme in physiotherapy the subject of clinical neurophysiology and for academic teachers in possession of

appropriate experience, qualifications and competency in the field of clinical diagnosis to run lectures and practical classes.

2. The content for the first degree should encompass lectures and practical classes in the field of classic electrodiagnosis and nerve conductivity, and at the second degree lectures and practical classes in electromiography and electroneurography. The teaching hours for clinical neurophysiology should be allotted from the total number of hours and/ or should be derived from a fusion of hours that concern clinical neurophysiology, which various teachers from various basic and specialised subjects allocate for the realisation of the education content.
3. There exists the possibility to realise such an innovative educational programme through the use of the specialist staff and training centres accredited by the Polish Association of Clinical Neurophysiology on the part of the institution of HE functioning in the territorial range of the said centre.
4. Institutions of HE can realise such a innovative programme of education by utilising financial resources allocated by the Ministry of Science and Tertiary Education for the realisation of the Operational Programme Human Capital Priority IV Tertiary Education and Science as well as that assigned by the Ministry for Regional Development for the realization of the operational programme Human Capital planned for the years 2007-2013.

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