



## Historical Issues in Sleep Medicine

## Bedřich Roth: pioneer in sleep medicine

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## ABSTRACT

Bedřich Roth was a Czech neurologist who dedicated his professional life to the study of sleep medicine. Shortly after WW2 he initiated a research program with an exclusive focus on narcolepsy and the hypersomnias. At the young age of 38 years, he published his first book. It was in Czech but had extensive English and Russian summaries. In 1967 he spent a study period in Marseille with Professor Henri Gastaut, who was very impressed by this bright and hardworking young neurologist. Dr. Roth, with his colleague Sona Nevšimalová, was the first to publish on the high frequency of depression in patients with narcolepsy and hypersomnia. He was the first person to define Idiopathic Hypersomnia and, along with Allan Rechtschaffen, to document the high frequency of sleep drunkenness in such patients. His many contributions, and his 65th birthday, were celebrated in 1984. Dr. Roth developed Hodgkin's lymphoma and passed away in November 1989. A conference celebrating his life and career took place in Prague in 2009. In 2015 the annual worldwide Idiopathic Hypersomnia Awareness Week organized by Michelle Chadwick celebrated the 35th anniversary of his 1980 book "Narcolepsy and Hypersomnia". Dr. Roth was the first physician to dedicate his entire career to sleep medicine and his publications predated by more than two decades those of all other authors. Bedřich Roth should therefore be considered to be the true father of sleep medicine. He was known widely for his integrity, humility, honesty, and his perseverance to achieve his goals.

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## 1. The beginnings

Bedřich Roth was born on the 23rd of March, 1919, into a Jewish family in Ruzomberok, Slovakia, some 200 km north of Budapest. His early schooling and his under-graduate time in medicine [Fig. 1] at Charles University, Prague, were unremarkable.

However, young Bedřich's life became irreversibly changed 20 years later in 1939 due to the German Anschluss into the Bohemian and Moravian parts of then Czechoslovakia that triggered World War II.

He returned to his natal town of Ruzomberok in Slovakia from 1939 to 1941 where he trained and worked, of all things, as a locksmith while studying medicine at night. In 1941 he was called up by the Czechoslovakian army that, alongside the German Wehrmacht, was fighting the Russians. Despising the control of the Czech army by the occupying German forces Bedřich, along with a

cousin and two friends, decided to desert. He escaped to Switzerland in mid-August 1941 while hidden for eleven days under the false floor of a cart that carried sawn lumber for a Swiss purchaser.

To be captured by the Germans while fleeing from Czechoslovakia to free Switzerland would have meant to be sent to a concentration camp, or much worse. He and his cousin were together in one of the two carts. On several occasions they had to remain totally silent while the cart was not moving and was surrounded by either Germans or by Czech Wehrmacht sympathizers. After they emerged in Switzerland from their hiding place in the cart, Bedřich sought political asylum and ended up in a Swiss labour camp. Fortunately, after an audience with the Dean of Medicine in Bern, Bedřich was released from the camp and permitted to continue his medical studies.

In December 1944 he learned that a ship transport of compatriots would be leaving France to join the free Czech army in England. With the Vichy government settled in power in Paris and in nearby Vichy, the Swiss-France border had become open. A letter of introduction to Professor Brian Matthews in Oxford, England, had

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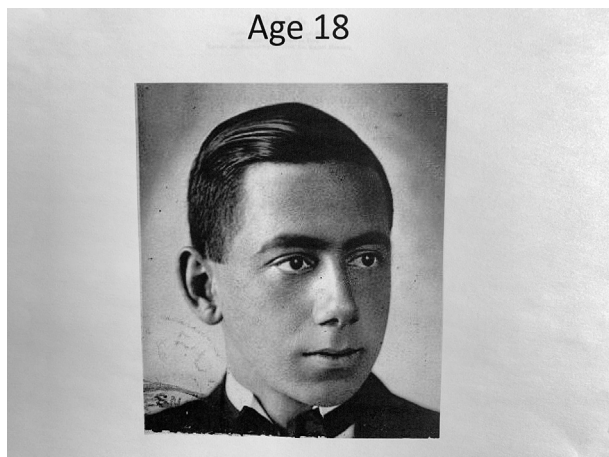


Fig. 1. Bedřich Roth as a young 18 year old medical student in Prague.

been given to him by a Bern physiology professor for whom he had worked part-time.

In 1934 Brian Matthews and Edgar Adrian [1] had been the first to confirm the existence of the human alpha rhythm that had been discovered five years earlier in 1929 by Hans Berger of Jena, Germany [2]. Bedřich arrived in France on Christmas day, 1944, and soon after was sent to the École Militaire where, once again, he had to pass his medical exams.

When it became apparent that Bedřich would not be able to leave Paris for England, he approached Dr. Léon Binet, the physiologist Dean of the Université de Paris. Bedřich explained his situation, mentioned his studies in Bern, showed his letter of introduction to Professor Matthews, and described his work done while at the Bern Institute of Physiology. Binet permitted him to stand for the French medical matriculation exams and stressed that he urgently needed to improve his French. He succeeded in both.

It is therefore evident that several of Dr. Roth's outstanding characteristics were shown early in his career. These are: his courage and resilience; his ability to take chances (both personal and career-wise); his tenacity in following his self-chosen interests; and his exposure to multiple cultures with his related increasing multi-linguistic competence. Bedřich would eventually read and speak fluently Czech, German, French, English and Russian. This was a talent that would make it possible for him to keep abreast of the medical literature of the world. At that time most researchers and clinicians could only read publications in their native language. Dr. Roth's own recollections of his early life, training and career are available in [Appendix A](#).

Bedřich Roth began to train in neurology at the world famous Neurology Department of the Hôpital Salpêtrière which at that time was headed by Professor Georges Guillain. This department was where earlier Freud had attended Charcot's famous clinical sessions on hysteria. Most of Bedřich Roth's time was spent as an extern with Professor Guillain. It was at the Salpêtrière that Bedřich encountered his first two patients with narcolepsy. These patients were questioned very carefully by Dr. Pierre Mollaret, who was in charge of the neurology teaching sessions. Dr. Mollaret wished to determine whether or not the patients had cataplexy and, in one of the patients, also sleep paralysis, which he aptly and elegantly described as “sommeil somatique avec éveil psychique”.

The group of conditions we now at times refer to as the neurological hypersomnias were seldom recognised despite the earlier detailed descriptions of Constantin von Economo [3] and others. The full range of clinical signs and symptoms, etiologies, and neuropathology were all largely un-documented. This was despite

the fact that the great encephalitis pandemic and the Spanish influenza epidemics of 1917–1921 had left many survivors with chronic symptomatic hypersomnia.

## 2. The early years of independent work

After finishing his medical training in Paris, Bedřich received a diploma from Charles University in Prague that he required in order to practice medicine in Czechoslovakia. He then began working for a period as a neurologist in Hradec Kralove, and later at the Department of Neurology, Charles University and the University Hospital in Prague (Karolinska 30, Prague 2). His clinical and scientific interest was focused at the beginning on the whole field of neurology and neurophysiology, from which crystalized a target to sleep medicine. Bedřich rapidly initiated an independent clinical research program that was focused on narcolepsy, idiopathic hypersomnia, and the symptomatic hypersomnias, as well as the fascinating recurrent form of recurrent hypersomnia known as Kleine-Levin syndrome.

From 1952 to 1957 Roth's work included a number of interesting studies that were published in Czech where he recognized and recorded the clinical differences between narcolepsy and hypersomnia [4–9]. These included a very detailed paper on the EEG in narcolepsy published in 1952 [4]. He documented sleep drunkenness, a typical feature of idiopathic hypersomnia, that he first reported in a 1956 paper entitled Sleep Drunkenness and Sleep Paralysis [8]. It was during this period that Professor Roth was the first physician to realize that patients with hypersomnolence, but lacking the classic clinical features of narcolepsy, and without any other explanation for their symptoms, were suffering from an independent clinical entity.

In 1957, at only 38 years of age, Bedřich published in Czech his first book *Narcolepsie a Hypersomnie s hlediska fysiologie spánku* (Narcolepsy and Hypersomnia from the Aspect of the Physiology of Sleep) [10]. It was based upon 104 patients with so-called essential narcolepsy (cataplexy was observed in 70 of them) and 93 patients with hypersomnia (50 with functional origin, 29 with organic basis, and 14 with so-called independent postdormital drunkenness). The book [Fig. 2] had detailed summaries in English and Russian. A more widely read German translation titled *Narcolepsie und Hypersomnie* [Fig. 3] appeared in 1962 [11].

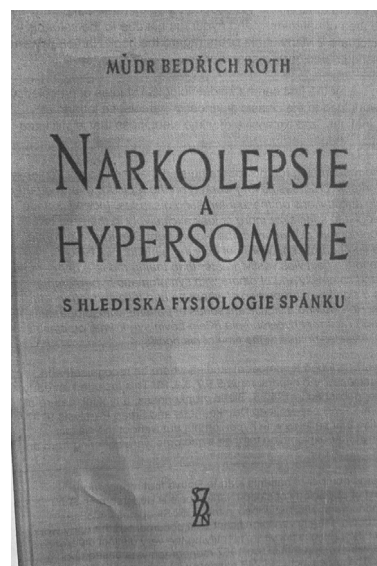
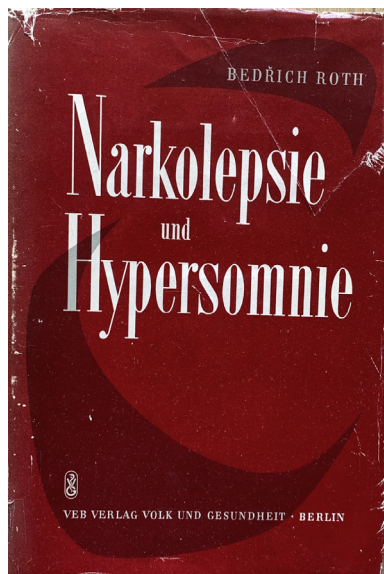


Fig. 2. Bedřich Roth's first single authored book on narcolepsy and hypersomnia published in Czech with English and Russian summaries.

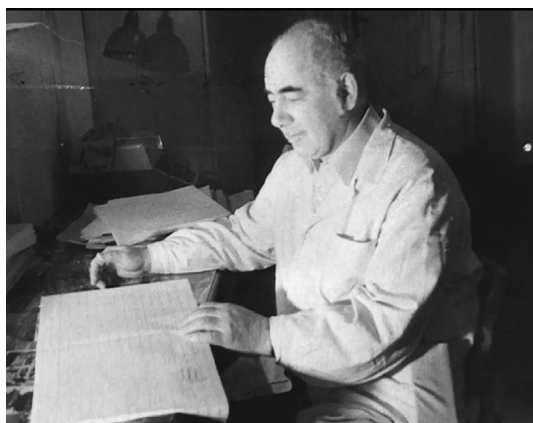


**Fig. 3.** The German translation of Bedřich Roth's Czech book which had greater readership than the first book. It included some increase in the number of patients with various diseases. It has 28 chapters, 428 pages and a very extensive bibliography.

In 1962, Professor Roth began the first polysomnographic recordings [Fig. 4] in the Prague EEG lab. First only a channel for breathing movements was used. Later, in 1965, channels recording chin muscle tone and eye movements were added as well. It was the first true diagnostic sleep lab in central Europe.

Four years earlier, in 1958, Bedřich had managed to negotiate a six-week period of leave in order to study in Marseille with Professor Henri Gastaut at his internationally famous center for epilepsy and clinical neurophysiology. From personal conversations of the corresponding author with Henri Gastaut, it was evident that Gastaut was very impressed by this young Czech visitor whom he said to be “objective, hardworking, and totally trustworthy”.

Based on this rewarding experience and his careful data gathering in Marseilles, in 1961 Bedřich was provided a full hour in which to present his findings in Rome at the International Congress of Electroencephalography and Clinical Neurophysiology. That presentation was the basis of a landmark article in the EEG Journal [12]. The focus of the article was on the electroencephalographic changes that occur across the spectrum of alert wakefulness, drowsiness, sleep onset, and sleep offset, in patients with



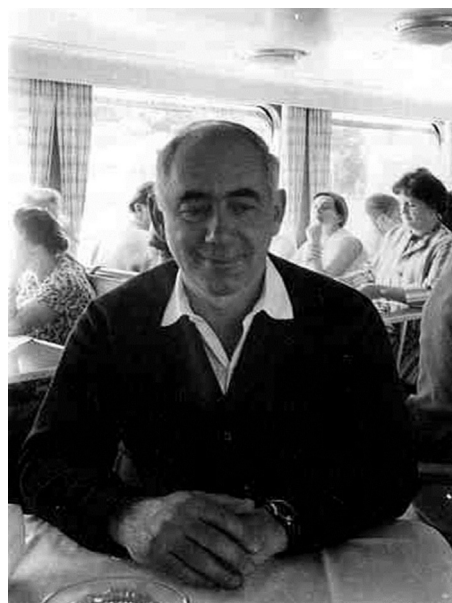
**Fig. 4.** Bedřich Roth analyzing an EEG.

narcolepsy compared to the patterns of normal control subjects. This detailed description was not equaled until 26 years later, in 1987, when the book on sleep onset EEG changes by Santamaria and Chiappa was published [13].

### 3. Bedřich Roth's early contributions

During this time Dr. Roth accepted an invitation from Allan Rechtschaffen to visit his sleep laboratory in Chicago. Their first collaboration was published in 1969, and was titled The nocturnal sleep of hypersomniacs [14]. Their second and more important paper gave a detailed and complete clinical description of hypersomnia with sleep drunkenness and was published in 1972 [15]. Forty-eight of the patients were studied at the Department of Neurology in Prague between 1949 and 1969 and ten patients were examined at the University of Chicago Sleep Laboratory during Dr. Roth's visit in 1967. All patients underwent repeated neurological and electroencephalographic examinations. Many were also studied by polysomnography for short 30 to 60-min periods during the day. The patients in Prague were observed over many years, some for over 20 years [15]. The year 1972 also saw the creation of the European Sleep Research Society which was established in Basel, Switzerland. Dr. Roth was one of the founding members, as is the corresponding co-author of this article.

Other collaborations resulted in further polygraphic studies in narcolepsy and idiopathic hypersomnia [16] and investigations into the psychological and socioeconomic impact of idiopathic hypersomnia on the life of the patient that were written with the corresponding co-author of this article [17]. The first International Symposium on Narcolepsy took place in 1975 at la Grande Motte, 15 km east from Montpellier. Dr. Roth made a fascinating contribution on the functional hypersomnias. One year later he published his landmark paper entitled Narcolepsy and Hypersomnia: review and classification of 642 personally observed cases [18]. Dr. Roth's years of extensive research led to his description of idiopathic hypersomnia as a separate disease entity which was widely accepted and was included in the first Diagnostic Classification of Sleep and Arousal Disorders in 1979 [19].



**Fig. 5.** Bedřich Roth at age 40.



**Table 1**

The number of patients with narcolepsy, idiopathic hypersomnia, symptomatic hypersomnia, and other diagnoses in Roth's books and the monograph on Kleine-Levin syndrome.

Publications	Total #	#Narcol	# idiopath	#Sympto	#other
1957 Narkolepsie a Hypersomnie (Czech)	349	104	93	29	14
1962 Narcolepsie und Hypersomnie (German)					
1980 Narcolepsy and Hypersomnia (English)	620	360	167	64	29
1986 In: Koella, Ed. Sleep 1968	1000				
1972 Kleine-Levin Syndrome (Smolik and Roth)	14				

One of the striking features of Bedřich Roth's output in this early period of his career was the wide range of languages in which he published. There are articles in Czech, German, English, French and Russian. Indeed, like Nathaniel Kleitman, who was born in Russia and wrote in his landmark 1963 book *Sleep and Wakefulness* in which he cited publications in eight languages [20], Bedřich made a conscious effort to cite all significant articles relevant to his own work, whatever their language.

Remarkably for someone so early in his or her career, Bedřich Roth [Fig. 5] began in 1957 to publish single authored books, and on one occasion a double authored book, as well as monographs on narcolepsy and the hypersomnias. By comparison, the earliest modern era book by others was the 1985 multi-authored volume *Narcolepsy* edited by Guilleminault, Dement and Passouant [21]. It was published 18 years after Professor Roth's first book.

One reason for Bedřich Roth's textbook approach would appear to be the fact that his series of books kept updating the analyses of his rapidly increasing database of patients. The volumes also illustrate the evolution of his ideas concerning narcolepsy and the hypersomnias. The number of patients, and the careful long-term follow-ups, were unique when compared to others working at the same time in the same field. These data were also updated regularly between the books. This remarkable growth is documented in Table 1.

It must be mentioned that Bedřich Roth was a master mentor who supervised a large number of trainees in neurology. Two persons trained by him have remained in Prague as full-time clinician-scientists in sleep medicine, and they continue to work at the cutting edge of medical research in neurological sleep disorders. These are, of course, Sona Nevšímalová, who is currently engaged in research on the molecular genetics of narcolepsy and Karel Šonka who has contributed greatly to restless leg syndrome, periodic movements in sleep and REM Sleep Behavior Disorder.

In 1980 Dr. Roth published his landmark English volume *Narcolepsy and Hypersomnia* [22]. This book [Figs. 6 and 7] covered virtually all aspects of narcolepsy with and without REM-based symptoms and idiopathic hypersomnia, with and without sleep drunkenness, and the various forms of symptomatic hypersomnia. We wish to emphasize the importance of this excellent book. In the 1970s and 1980s Professor Roth had the largest material in the world of patients suffering from excessive daytime sleepiness. The book provides a detailed survey of 620 patients observed personally over a period of 26 years. Of the 23 chapters in the volume, five were co-authored with Professor Broughton. These included chapters on: the physiology of sleep; electroencephalography and polygraphy of sleep; the clinical assessment of patients with narcolepsy or hypersomnia; an historical survey of knowledge of narcolepsy and hypersomnia; and the pathophysiology of narcolepsy symptoms.

In 1984, at the First European Congress of Neurology, which was held in Prague, internationally well-known sleep clinician-

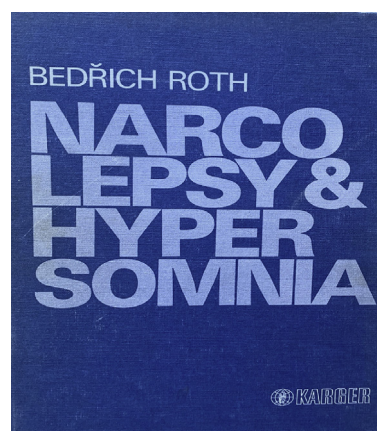
researchers presented in the symposium “Narcolepsy and Hypersomnia” and celebrated the 65th birthday of Dr. Roth [Fig. 8].

At the request of the corresponding author, Professor Roth created a comprehensive bibliography of his publications from 1946 to 1989 (see Appendix A). His output is astonishing and includes 6 books, 42 book chapters, 206 refereed journal papers and 88 abstracts. This period also saw the landmark publication of the monograph “Kleine-Levin Syndrome Etiopathogenesis and Treatment” [Fig. 9] co-authored with his psychiatric colleague Petr Smolik [23].

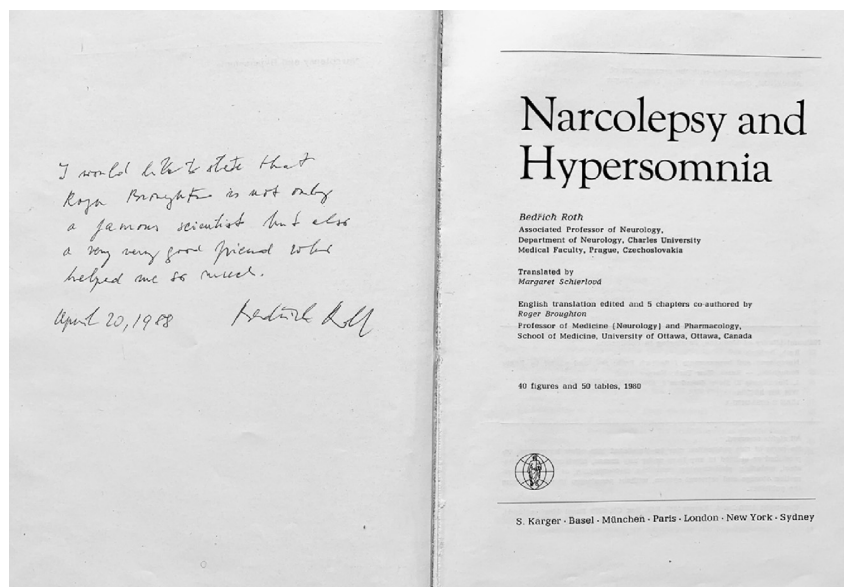
This excellent monograph reviewed the history of the views on diagnosing Kleine-Levin syndrome, the EEG in both the episodes of hypersomnia and between them. The monograph reviews the literature of the pathophysiology of the conditions. There is an in-depth analysis of all aspects of the condition in their pooled group of patients and of patient treatment. The monograph has 144 references.

#### 4. The socioeconomic studies

When it was decided in Ottawa to do a controlled study of the psychosocial impact of narcolepsy-cataplexy, Dr Roth immediately and enthusiastically asked whether he could collaborate to enlarge the study and use the same questionnaire translated into Czech. No such controlled study with matched normal subjects had been published on the psychosocial impact and quality of life for any sleep disorder. At the same Grande Motte congress Professor Yasuo Hishikawa overheard that the proposed study was going to include both Canadian subjects and Czech subjects. He requested to become a third center to participate, and stated that he would translate the questionnaire into Japanese.



**Fig. 6.** The cover of Bedřich Roth's monumental 1980 book *Narcolepsy and Hypersomnia* published by Karger Press, Basel, Switzerland.



**Fig. 7.** The title page of the book notes that 5 chapters were co-authored by Bedřich Roth and Roger Broughton, The latter author also edited the entire English text of the book. The very kind handwritten note to the left reads: "I would like to state that Roger Broughton is not only a famous scientist, but also a very good friend, who helped me so much" Bedřich Roth, April 20, 1988.



**Fig. 8.** The First European Congress of Neurology was held in Prague on April 19, 1988 and included a one-day "Symposium on Narcolepsy and Hypersomnia". The lead speakers were from left to right; Drs. Peter Geisler, Michel Billiard, Roger Broughton, Sona Nevšimálová, Bedřich Roth, Christian Guilleminault, and David Parkes.

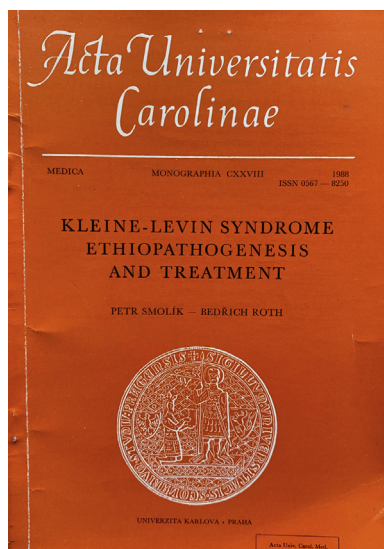
The study ended up with 60 patients with narcolepsy-cataplexy and 60 age and sex matched normal controls in each of the three participating centers. The questionnaire contained just over 160 questions to which the subject had to choose between answering with a yes, a no, or a don't know. This study of the psychosocial impact of narcolepsy was the first controlled one to be published. It documented the truly massive negative impact of the disease on work, driving, accidents, personality, mood, and many other areas [24]. In a separate analysis of the data which compared the psychosocial impact of narcolepsy in the three geographic regions, the areas of greatest socio-economic impact were essentially the same in the Caucasian (Canadian), Slavic (Czech) and Oriental (Japanese) populations [25]. So the broad and very severe impact appeared to be inherent to the disease itself and not be due to social or genetic

factors. Without Professor Roth's rapid and enthusiastic decision to participate, no doubt Professor Hishikawa would not have joined, and the study would have been a relatively minor one with only 60 Canadian patients and 60 Czech patients with narcolepsy-cataplexy and their matched controls.

## 5. Early contributions

Bedřich Roth's sustained commitment to better understand narcolepsy and the hypersomnias began with careful and extensive medical records of their symptoms, repeated neurological examinations, documentation of family trees for possible disease transmission, attempts to elucidate etiology, and their electrophysiological correlates.





**Fig. 9.** The Kleine-Levin Syndrome monograph co-authored by Bedřich Roth and his colleague Petr Smolik.

Particularly important early contributions were the first clear documentation of the very high frequency of depression in these conditions by Bedřich Roth and Sona Nevšimalová [26] and the peculiar and complex behavioral patterns upon awakening which were referred to as sleep drunkenness and had been earlier described in other conditions by Marc in 1840 as “l’ivresse du sommeil” [27], and by von Gudden in 1905 as “Schlaftrunkenheit” [28]. Dr. Roth found that sleep drunkenness was present in about 40 percent of his patients with idiopathic hypersomnia.

In 1965 Dr. Roth presented one of the first reports on the polygraphic study of narcolepsy and the hypersomnias at the 6th International Congress of Electroencephalography and Clinical Neurophysiology in Vienna [29]. In 1969 Roth, Brůhová and Lehavsky published a study on REM and NREM sleep in these disorders [30]; and in the same year they published two of the first papers using polysomnography which focused on dreams in narcolepsy and hypersomnia [31,32].

## 6. Professor Roth's major contributions

1. His first 1957 Czech book, was translated into German and republished in 1962 as *Narkolepsie und Hypersomnie vom Standpunkt der Physiologie des Schlafes* [11], Dr. Roth provided the first large scale case series with detailed and accurate clinical descriptions, definitions, classifications and at times even sub-classifications of the various forms of narcolepsy and of idiopathic and symptomatic hypersomnias [Figs. 2 and 3].
2. Dr. Roth published the first descriptions of long-term follow-ups in his patients. Documentation of follow-ups is obviously of great importance in all chronic diseases. His case series of patients with narcolepsy and hypersomnia was very large and even today very few centers that are focused on narcolepsy can match its size.
3. In collaboration with Dr. Sona Nevšimalová [Fig. 10] Bedřich Roth carefully documented family trees, and together they published clinical genetic studies. These papers were significant because up until this time a genetic mechanism had not been explored in these disorders [33].
4. As mentioned earlier, Bedřich Roth and Sona Nevšimalová were the first authors to analyse and publish the high frequency and clinical importance of depression in both narcolepsy and the hypersomnias [26].
5. Dr. Roth co-authored the first investigations into the socio-economic impact of narcolepsy and idiopathic hypersomnia on the life of the patients. These were the first socioeconomic studies of any sleep disorder [24,25].
6. He presented at many important international meetings including the first International Conference on Narcolepsy. He also became a founding member of the European Sleep Research Society.
7. Dr. Roth is responsible for the first careful epidemiological studies of narcolepsy and idiopathic hypersomnia that led to the classic diagnostic “narcoleptic tetrad” i.e., cataplexy, sleep paralysis, hypnagogic hallucinations, and excessive daytime sleepiness that is still used today [34].
8. Dr. Roth contributed to our first manual for sleep stage scoring manual that was edited by Rechtschaffen and Kales



**Fig. 10.** Sona Nevšimalová with Bedřich Roth at the 1984 Symposium Narcolepsy and Hypersomnia held in Prague.



**Fig. 11.** Bedřich Roth at 68 years of age enjoying a stroll in Prague's Old Town Square despite his serious symptoms from Hodgkin's lymphoma.

[35] but, in fact, had 12 co-authors. He was one of only three non-Americans to participate, the other two being Michel Jouvet of Lyon, France, and Ian Oswald of Edinburgh, Scotland.

9. In 1986 he published on the Polygraphic Score of Sleepiness [36] (PSS) that he had developed to quantify sleepiness as a practical alternative to the multiple nap MSLT. It was based on a single afternoon 45-min nap and used the latencies of sleep stages and weighted coefficients for sleep stage amounts. The 45-min PSS proved as sensitive as the 10-h MSLT in quantifying the sleepiness of patients with EDS.
10. In a fitting end to an outstanding body of work, Dr. Roth's group, in collaboration with the Max Planck Institute in Germany, was one of the first to discover an association between HLA DR2 and Narcolepsy [37].
11. Lastly, and perhaps most importantly, Bedřich Roth was the first person to initiate a sustained program of research into narcolepsy and the hypersomnias. It clearly put Prague on the map of research centers focused on narcolepsy and the hypersomnias and it predated, by two decades or more, other major contributors such as the groups at Stanford, Montpellier, Bologna, London, Osaka and Ottawa. Professor Roth established a center of excellence in Prague which continues to flourish in his absence under the leadership of Professor Sona Nevšimalová and, more recently, her successor Karel Šonka.

## 7. His priority

Subsequent to the publications of Bedřich Roth, which began in 1952, the earliest specialists in sleep medicine with a strong commitment to do research on narcolepsy and the hypersomnias were in Bologna, initiated by Elio Lugaresi; in Montpellier, by Pierre Passouant; in the United States, by William C. Dement; and in Osaka, Japan, by Yasuo Hishikawa. Later groups beginning in the 1970s included those by David Parkes in London; Karlheinz Meier-Ewert and then Geert Mayer in the Hephata Klinik in Schwalmstadt-Treysa, Germany; Claudio Bassetti in Zurich, then Bern; Tomas Pollmächer in Munich; and Roger Broughton in Ottawa.

Bedřich Roth's publications in sleep medicine began in 1952 and predate all of these groups by at least 20 years. Incontestably,

Bedřich Roth was the founding pioneer in the study and treatment of narcolepsy and the hypersomnias. From 1952 to 1963 Dr. Roth's publications on narcolepsy and the hypersomnias totaled 2 books and 27 refereed articles: 3 in German, 2 in English, 2 in French and the remaining 20 in Czech.

Despite his Hodgkin's lymphoma and its disabling symptoms including marked fatigue he remained active and positive until his passing [Fig. 11].

On April 24, 2009, a 2-day symposium on "Narcolepsy and Hypersomnia" was held in Prague in honour of the late Bedřich Roth [Fig. 12]. The opening morning speakers, in order of presentation, were Roger Broughton, Sona Nevšimalová, Michel Billiard, Emmanuel Mignot, Claudio Bassetti, Geert Mayer and Thomas Pollmächer.

## 8. Idiopathic Hypersomnia Awareness Week, 2015

In 2015 the co-author of this article, Michelle Chadwick, of Brisbane, Australia, organized a tribute to Bedřich Roth and his extraordinary contributions to neurological sleep research combined with a celebration of the 35th anniversary of the publication in 1980 of Dr. Roth's classic textbook *Narcolepsy and Hypersomnia* [22]. A number of past and current prominent neurological sleep researchers were interviewed for the tribute including Michel Billiard, Sona Nevšimalová, Karel Šonka, Roger Broughton, Isabelle Arnulf and David Rye [38].

All of them agreed that Dr. Roth's seminal publications over many years on narcolepsy and idiopathic hypersomnia have left an indelible mark on the history of sleep medicine. Dr. Billiard remarked that Professor Roth's definition of idiopathic hypersomnia has remained the same over time. Professor Šonka agreed stating: "The official diagnostic criteria have changed three times. The disease, as it was described by Roth in the 1950's, remains the same". This is significant, because it shows that Bedřich Roth's careful, detailed studies, and the recording and follow up of his large number of patients over many years, have stood the test of time.

Indeed, research into narcolepsy has come a long way since Bedřich Roth's early studies. With the discovery of hypocretin/orexin deficiency being unique to narcolepsy type 1, we now know that Roth's very early observations were accurate in that narcolepsy type 1 and idiopathic hypersomnia are separate disease entities. Professor Roth also noted that narcolepsy type 2 was more similar



PROGRAMME OF THE „SYMPOSIUM ON NARCOLEPSY AND HYPERSOMNIA“	
Friday, April 24, 2009	
09.00 – 09.10	OPENING CEREMONY
SESSION 1	
09.10 – 09.30	IN MEMORY OF BEDŘICH ROTH <u>R. Broughton</u> (Canada)
09.30 – 10.00	BEDŘICH ROTH'S IDEAS IN PRESENT-DAY LIGHT <u>S. Nevšimálová</u> (Czech Republic)
10.00 – 10.30	IDIOPATHIC HYPERSOMNIA <u>M. Billiard</u> (France)
10.30 – 10.45	Coffee Break
SESSION 2	
10.45 – 11.15	NARCOLEPSY AND HYPOCRETIN: NEUROBIOLOGY, GENETICS AND IMMUNOLOGY <u>E. Mignot</u> , L. Appelbaum, J. Faraco, L. Lin, P. Murrain, T. Yokogawa, S. Zhang (USA)
11.15 – 11.45	CLINICAL SPECTRUM OF NARCOLEPSY <u>C. Bassetti</u> (Switzerland)
11.45 – 12.15	COMORBIDITY OF NARCOLEPSY AND IMPLICATIONS OF AGE AT ONSET IN NARCOLEPSY <u>G. Mayer</u> (Germany)
12.15 – 12.45	METABOLIC ASPECTS OF NARCOLEPSY <u>T. Pollmächer</u> (Germany)

Fig. 12. Program of the 2-day symposium on “Narcolepsy and Hypersomnia” which was held in Prague in 2009 in honour of the late Bedřich Roth.

to what he described as monosymptomatic hypersomnia, or idiopathic hypersomnia, without long sleep, than it is to narcolepsy type 1. Two recent papers authored by 21 of the world's narcolepsy and idiopathic hypersomnia researchers agree that narcolepsy type 1 and idiopathic hypersomnia with long sleep should be classified

concept of idiopathic hypersomnia from Roth's work in the very beginning in 1956. Also, that diagnostic polysomnographic criteria require continuous readjustment, thus there is an urgent need for biological markers., current pathophysiological avenues, and new therapies.”

What is it about Idiopathic Hypersomnia that you feel is important for people to know?

“Polysomnographic diagnostic criteria require continuous readjustment thus the urgent need for biological markers.  
– Current pathophysiological avenues  
– New therapies”

– Prof. Michel Billiard

Bedřich Roth, His Life's Work and the 35th anniversary of his book "Narcolepsy and Hypersomnia".  
Idiopathic Hypersomnia Awareness Week 2015  
Hypersomnolence Australia

as separate disease entities and that narcolepsy type 2 and idiopathic hypersomnia without long sleep should be merged into one [39,40].

Each of the researchers interviewed for the Roth tribute was asked what is it about Idiopathic Hypersomnia that they feel is important for people to know? Dr. Billiard said “The history of the

Professor Šonka said it was important that idiopathic hypersomnia with long sleep is acknowledged as a “true” and disabling neurological sleep disorder. “It is a fact that there is a disease producing much longer sleep and greater sleepiness. Morbidly sleepy people are not lazy. Sleepiness is a symptom of the disease”.



What is it about Idiopathic Hypersomnia that you feel is important for people to know?

“Morbidly sleepy people are not lazy and sleepiness is a symptom of the disease”

– Prof. Karel Šonka

Bedřich Roth, His Life's Work and the 35th anniversary of his book "Narcolepsy and Hypersomnia".  
Idiopathic Hypersomnia Awareness Week 2015 –  
Hypersomnolence Australia

## 9. The summing up

We believe, for a number of reasons, that Bedřich Roth should be universally considered as the true father of modern sleep medicine. He was the first physician to dedicate his entire career to the study and treatment of sleep disorders. He contributed more than any other physician to the practical aspects such as taking a very careful medical history, doing a thorough physical examination, studying patients with overnight polysomnography, keeping careful records, and finding a more efficient way than the MSLT to quantify excessive daytime sleepiness by introducing the Polygraphic Score of Sleepiness; by his rigorous classification of the hypersomnias; and, above all, by his initiating very early in his career a rational and expanding program of research on narcolepsy and the hypersomnias which began in 1952 and predated all other physicians committed to clinical research on narcolepsy and the hypersomnias by more than two decades. The very roots of Sleep Medicine are therefore European and not North American. A very interesting video of the reminiscences of Bedřich Roth's son, Dr. B. Roth, and of Professor Sona Nevšímalová is included in [Appendix A](#).

## 10. Bedřich Roth's passing

Bedřich Roth's last 20 years were stigmatized by his depression and the necessary antidepressant medication. At the time of his death due to Hodgkin's lymphoma on 4 November 1989, at age 70, Professor Bedřich Roth MD, DrSc was: a leading scientist of the Laboratory for the Pathophysiology of the Nervous System in Prague; a member of the staff of the Department of Neurology of Charles University Medical Faculty, Prague; the recipient of the J. E. Purkyně Medal of Charles University; an Honorary Member of the Czechoslovak Society for EEG and Clinical Neurophysiology; Honorary Member of the Czechoslovak Society of EEG and Clinical Neurophysiology; a founding member of the European Sleep Research Society and, for many years, a member of its Scientific Council; member of the International Scientific Council of the Narcolepsy Research Institute of Stanford University, California; Honorary Member of the American Sleep Disorders Association; the first Honorary Member of the Canadian Sleep Society; member of the Society for EEG and Clinical Neurophysiology; member of the Society for EEG and Clinical Neurophysiology of both the Federal Republic of Germany and the German Democratic Republic; and

honorary Member of the Hungarian Society for EEG and Clinical Neurophysiology.

This remarkable clinician-researcher is remembered fondly by his many friends, his colleagues and his international acquaintances, as someone who was kind, gentle, loyal, generous, dedicated, widely respected and, as Henri Gastaut, had said, was totally trustworthy.

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## Conflict of interest

Both authors declare that they have no conflicts of interest.

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: <https://doi.org/10.1016/j.sleep.2020.11.002>.

## Appendix A. Supplementary information

Bedřich Roth's person account of his early life and his career can be found by clicking on the following link: [https://ebff3985-1fd0-4dec-b74c-e34a3827ac14.filesusr.com/ugd/a1218b\\_d5facee293594b8ba71ee76501f4fa20.pdf](https://ebff3985-1fd0-4dec-b74c-e34a3827ac14.filesusr.com/ugd/a1218b_d5facee293594b8ba71ee76501f4fa20.pdf).

Bedřich Roth's hand typed bibliography from 1946 to 1987 can be found by clicking on the following link: [https://ebff3985-1fd0-4dec-b74c-e34a3827ac14.filesusr.com/ugd/a1218b\\_d5facee293594b8ba71ee76501f4fa20.pdf](https://ebff3985-1fd0-4dec-b74c-e34a3827ac14.filesusr.com/ugd/a1218b_d5facee293594b8ba71ee76501f4fa20.pdf).

A very interesting video of the reminiscences of his son Dr. B. Roth and his colleague Sona Nevšímalová can be found by clicking on the following link: [https://youtu.be/7YvL\\_SLser0](https://youtu.be/7YvL_SLser0).

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