



# European Sleep Research Society

## 1972 – 2012

### 40<sup>th</sup> Anniversary of the ESRS

Editor: Claudio L. Bassetti  
Co-Editors: Brigitte Knobl, Hartmut Schulz



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**Imprint****Editor**

Claudio L. Bassetti

**Co-Editors**

Brigitte Knobl, Hartmut Schulz

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# Table of Contents

<b>Presidential Foreword</b> . . . . .	5
<b>Future Perspectives</b>	
<b>The Future of Sleep Research and Sleep Medicine in Europe: A Need for Academic Multidisciplinary Sleep Centres</b> C. L. Bassetti, D.-J. Dijk, Z. Dogas, P. Levy, L. L. Nobili, P. Peigneux, T. Pollmächer, D. Riemann and D. J. Skene . . . . .	7
<b>Historical Review of the ESRS</b>	
<b>General History of the ESRS</b> H. Schulz, P. Salzarulo . . . . .	9
<b>The Presidents of the ESRS (1972 – 2012)</b> T. Pollmächer . . . . .	13
<b>ESRS Congresses</b> M. Billiard . . . . .	15
<b>History of the Journal of Sleep Research (JSR)</b> J. Horne, P. Lavie, D.-J. Dijk . . . . .	17
<b>Pictures of the Past and Present of Sleep Research and Sleep Medicine in Europe</b> J. Horne, H. Schulz . . . . .	19
<b>Past – Present – Future</b>	
<b>Sleep and Neuroscience</b> R. Amici, A. Borbély, P. L. Parmeggiani, P. Peigneux . . . . .	23
<b>Sleep and Neurology</b> C. L. Bassetti, L. Ferini-Strambi, J. Santamaria . . . . .	27
<b>Psychiatric Sleep Research</b> T. Pollmächer . . . . .	31
<b>Sleep and Psychology</b> D. Riemann, C. Espie . . . . .	33
<b>Sleep and Sleep Disordered Breathing</b> P. Levy, J. Hedner . . . . .	35
<b>Sleep and Chronobiology</b> A. Wirz-Justice, D. Skene, D.-J. Dijk . . . . .	37
<b>Sleep and Animal Research</b> I. Tobler . . . . .	39
<b>Dream Research</b> M. Schredl, S. Schwartz . . . . .	41
<b>Sleep and Genetics</b> P. Franken, M. Tafti . . . . .	43
<b>Sleep Through the Life Span: The First and the Last Steps</b> P. Salzarulo . . . . .	47
<b>Childhood Sleep Medicine</b> O. Bruni . . . . .	49
<b>Sleep and Memory</b> P. Maquet, P. Peigneux . . . . .	51
<b>Sleep Medicine: Accreditation and Certification</b> D. Pevernagie, T. Penzel . . . . .	53

# Table of Contents

<b>Sleep and Work</b>	
T. Åkerstedt, G. Kecklund . . . . .	55
<b>Epidemiological Sleep Research in Europe</b>	
M. Partinen . . . . .	57
<b>The Founders of European Sleep Research and Sleep Medicine</b>	
<b>Manasseina, Pavlov and the Russian School</b>	
V. M. Kovalzon . . . . .	59
<b>Von Economo and the Hypothalamus</b>	
R. Khatami, C. Baumann, C. L. Bassetti . . . . .	61
<b>Henri Piéron, the Pioneer of 20<sup>th</sup> Century Sleep Research</b>	
C. Gottesmann . . . . .	63
<b>Michel Jouvet and the Lyon School</b>	
P.-H. Luppi . . . . .	65
<b>W. R. Hess and the Swiss School</b>	
C. W. Hess . . . . .	67
<b>Frédéric Bremer 1892 – 1982: His ‘Cerveau Isolé’ and ‘Encéphale Isolé’ Preparations</b>	
M. Kerkhofs, D. Pevernagie . . . . .	69
<b>Giuseppe Moruzzi: An European School of Neurophysiology in the University of Pisa</b>	
C. Batini . . . . .	71
<b>R. Jung, W. Kuhlo, J. H. Peter and the German School</b>	
T. Penzel . . . . .	73
<b>Elio Lugaresi and the Italian School</b>	
F. Cirignotta . . . . .	75
<b>40 Years ESRS: A Historical Photo Collection</b>	77
<b>The National Sleep Societies</b>	83
<b>Index of Authors</b>	125
<b>Index</b>	127

# Presidential Foreword

**“The farther backward you can look,  
the farther forward you are likely to  
see.”**

*Winston Churchill*

At the bi-annual meeting of the European Sleep Research Society in Paris the society will celebrate its 40<sup>th</sup> anniversary. I thought that this would be a good occasion to look back at our history, as we did in 1997 on the occasion of our 25<sup>th</sup> anniversary. The initial plan to “just” update the first book was soon replaced by the idea of offering a more detailed reflection on the history, present and future of the ESRS and more generally of sleep research and sleep medicine.

The book is structured into four parts. The first part offers a review of the history of the ESRS, its congresses, presidents and journal. The second part is composed of 15 “mini-reviews” on the past, present and future of specific areas of sleep medicine and sleep research. The third part is devoted to nine founders – and their schools – of sleep research in Europe. In the fourth final part the 29 European National Sleep Societies present themselves in terms of history, structure and activities. The contents of the book are rounded up by a contribution by the ESRS board and the Chief Editor of JSR on future perspectives of sleep research and sleep medicine in Europe and by a historical photo collection.

This book has turned out to be a great team effort with contributions from 72 authors, including six ESRS presidents, three chief editors of the Journal of Sleep Research, and 29 presidents of European National Sleep Societies.

Two people have had a fundamental role in the production of the book. Hartmut Schulz has been involved in the review process and proofreading of all the chapters. Brigitte Knobl has coordinated the entire editorial management of the book including the communication between authors and editors, as well as the review and production processes. Without their careful, patient and efficient work this book would not have been finalised.

Special thanks also goes to Jim Horne (review process), Ludger Grote (coordination of the contributions of the National Sleep Societies), Thomas Pollmächer and Lino Nobili. Anna Wirz-Justice and Peter Achermann were kind enough to send several pictures of ESRS members and events they had collected over the years.

It is my hope that reading (and looking at) this book will not only bring back pleasant memories to those whom have lived (parts) of this history but also sharpen the look of those who will make the future of our Society and the field of sleep research and sleep medicine.



Claudio Bassetti  
Bern, Switzerland  
August 2012



## The Future of Sleep Research and Sleep Medicine in Europe: A Need for Academic Multidisciplinary Sleep Centres

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The European Sleep Research Society (ESRS) embraces sleep research and sleep medicine in Europe in its mission. The history of the society (and its journal), the scientific and teaching contents of the bi-annual meetings, the activities and composition of the ESRS board and its bodies reflect a strong commitment to the entire field of sleep. Within this framework and on the occasion of the 40<sup>th</sup> birthday of the society it is important to reflect how sleep research and sleep medicine could be further developed in Europe and, more specifically, the strategic and institutional steps that may be needed to achieve this goal.

Basic (animal and human) sleep research activities in the sleep field started and developed in Europe under the remit of academic centres/universities. Similarly, most clinical and research activities in the field of sleep medicine were also initiated by academic institutions, usually medical faculties. The use of similar, EEG-centred neurophysiological methods made communication and interaction within the entire sleep field relatively straightforward until the 19 sixties and seventies.

Over the last few decades, profound changes in the sleep field have taken place. On the one hand, basic sleep research has diversified using new research approaches (e.g. neuroimaging, neurochemistry, genetics, molecular biology, chronobiology) and tools. On the other hand, sleep medicine has developed within traditional medicine (e.g. pulmonology, neurology, psychiatry, pediatrics) and non-medicine (e.g. psychology) specialties and spread in many European countries to non-academic hospitals and clinicians in private practice. As a result the sleep field has expanded but also “fragmented” into multiple areas with specific activities and expertise.

Today, only in a few (mostly academic) European centres do basic sleep research and multidisciplinary sleep medicine activities co-exist and interact “under the same roof”. Is this co-existence useful? Or should we rather accept an “atomization” (fragmentation) of the sleep field (as can be seen in research and clinical practice in general) and consider such multidisciplinary academic sleep centres as “relicts” of the past without any usefulness (and therefore justification) for the future?

Here we advocate that such centres are of great importance for the future development of both sleep research and sleep medicine, for the following reasons:

1. Although basic sleep research is well advanced in many areas, its translation into clinical reality, however, remains limited to some of them (e.g. chronobiology, cognitive neurosciences, genetics,...).
2. The evolution of sleep medicine (like any other medical specialty) requires regular and direct contact with sleep research, in order to allow a rapid and effective “translation” of knowledge (well illustrated by the discovery of the hypocretin neuronal system then within a few years of its role in physiology and narcolepsy).
3. Conversely, basic sleep researchers should be aware of and consider in their agenda the key-questions arising in the clinical arena (e.g. the role of the thalamus in sleep physiology was also triggered by the description of fatal familial insomnia).
4. Multiple sleep-wake disturbances quite frequently co-exist in a single patient (e.g. insomnia and/or daytime sleepiness with sleep-associated breathing disturbances), making a multidisciplinary clinical and research approach most adequate and effective.
5. The creation of a “critical mass” of interacting sleep researchers and clinicians is essential for educational (e.g. for the creation of master/PhD programs), political/academic, and – last but not least – financial (e.g. acquisition of competitive grants) gains.

The sleep field because of its strong inter- and multidisciplinary nature and the above-mentioned points represents an ideal example of modern medicine and biology and as such merits appropriate academic recognition. We believe that in order to guarantee the further development and growth of sleep research and sleep medicine, it will be necessary to create formal structures in which sleep research and sleep medicine can interact and develop in a comprehensive way.

Following the recognition of sleep medicine as an independent medical speciality\* in 2005 by the accreditation council on graduate medical education, in 2006 the American National Academy of Sciences recognized sleep disorders and sleep deprivation as an “unmet public health problem” and recommended the creation of interdisciplinary academic sleep programs. At that time (2006) only the Universities of Philadelphia (1991) and Harvard (2001) had already established comprehensive academic interdisciplinary sleep centers.

Based in the University of Pennsylvania Department of Medicine, the University of Philadelphia division's membership reflects the multidisciplinary nature of sleep medicine and research ([www.med.upenn.edu/sleepctr/](http://www.med.upenn.edu/sleepctr/)): “*The Division of Sleep Medicine provides high quality care serving patients with the whole range of sleep disorders. In providing care, the division ensures that findings from our research and that of others is transferred into practice. Our fellows come from many different disciplines, and*

# Future Perspectives

*receive training in all aspects of sleep medicine.*" Since 2006 five additional centers (Emory University, Northwestern University, Stanford University, University of Pittsburgh, University of Wisconsin) have been created (A. Pack, personal communication, August 2012).

Comparable initiatives in Europe are not yet completely achieved, although there is some progress in various and complementary forms. For instance, the Surrey Sleep Research Centre (<http://www2.surrey.ac.uk/fhms/research/centres/ssrc/>) is currently primarily focused on multidisciplinary and translational sleep research ranging from genetic studies to informatics, whereas the Freiburg University Center for Sleep Research and Sleep Medicine (<http://www.uniklinik-freiburg.de/psych/live/index.html>) develops an integrated clinical sleep medicine approach with research emphasis in the fields of psychiatric sleep and insomnia. Although similar initiatives also exist in other European Universities (e.g. Bern, Lyon, Milano, Split, Zurich), we still need a clear and well-defined academic anchoring for sleep medicine, sleep research and education of future sleep professionals.

In this respect, we believe that the following steps should be considered in the institutionalization of sleep at European universities:

1. Medicine, psychological and biological sciences faculties (and wherever possible other faculties e.g. sociology, arts and literature, economics ...) should ideally be involved.
2. Within faculties sleep centres should embrace both preclinical (e.g. physiology, anatomy, biochemistry, pharmacology, genetics, neuroscience ...) and clinical departments.
3. Within the clinical realm, the sleep centre should involve researchers and clinicians from as many specialties as possible including pulmonology, psychiatry and psychotherapy, psychology, neurology, paediatrics, ENT, nursing and possibly others (such as dental medicine, sports and nutritional medicine).
4. Given the current economic climate in Europe it seems unlikely that governing bodies of universities and faculties will be likely to invest substantial sums of money to institutionalize such sleep centres. Nevertheless, as a first step, clinicians and researchers at a European university should create workgroups/teams to promote joint educational and dissemination activities to raise awareness and attention to the sleep field. This can be manifested in the creation of Masters programs, and in series of seminars and lectures aiming at students in different fields, as well as to the general public.
5. In a next step the governing structures of the universities and faculties should be asked to grant the formation of multidisciplinary academic sleep centres, suggesting a formal structure for participants involved. A first practical step could be the establishment of joint websites and coordinated efforts to channel the flow of patients in the different out- and inpatient departments. Working closer together in research may also encourage application for interdisciplinary research grants, including those at EU level. Of particular importance is also the development of educational modules and curricula (e.g. master/PhD programs) for medical and non-medical students (e.g. postgraduates, nurses, technologists).
6. The European Sleep Research Society as a roof European sleep society may be of significant help as a partner in this process. ESRS initiates and supports both the European educational activities in sleep, and the European sleep networks. It is also dedicated to set the European standards for education and

certification of both medical and non-medical sleep experts, as well as for accreditation of sleep medicine centres. ESRS is currently in the process of publishing a catalogue of knowledge and skills for sleep specialists (medical, non-medical, and technologists) that could be used as a basis for the development of a standard European education curriculum in sleep.

7. It is unlikely that this kind of proposed development will take place at many universities throughout Europe within the next few years. However, we believe (and hope) that at least in countries where sleep medicine and sleep research are very active such sleep centres can be created and possibly develop into independent interdisciplinary divisions, departments or institutes within single universities.

In conclusion, academic multidisciplinary sleep centres are probably one if not the most crucial factor that will contribute to the future of the sleep field in Europe. This will be made possible only if all ESRS members actively engage and interact above disciplinary boundaries to develop novel, both sleep research, sleep medicine, and education-dedicated structures within our universities.

## General History of the ESRS

Hartmut Schulz<sup>1</sup> and Piero Salzarulo<sup>2</sup>

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### Background

Around the middle of the 20<sup>th</sup> century research on sleep and wakefulness was impelled by two key findings, (i) the role of the reticular formation for the activation of the brain (Moruzzi and Magoun) and (ii) the recognition of rapid eye movement sleep (Aserinsky, Kleitman, Dement) or paradoxical sleep (Jouvet). These events stimulated an unprecedented amount of research activities in the following years (Gottesmann, 2001) and led in the early sixties to the foundation of the Association for the Psychophysiological Study of Sleep (APSS) in the US, with annual meetings. Ten years after its first meeting, the APSS organised an international congress in Bruges, Belgium, June 19 – 24, 1971. Only three months later another International Symposium, under the title *The Nature of Sleep*, was organised by Dr. Uroš J. Jovanović in Würzburg, Germany, September 23 – 26, 1971. At the end of this meeting “After thorough discussion among the European participants of the symposium it was decided to found a *European Society for Sleep Research*. A preliminary committee was formed to organise the Society and plan the next congress. Those elected to the committee were WALTER BAUST, Düsseldorf, CLAUDE GOTTESMANN, Nice, UROŠ J. JOVANOVIĆ, Würzburg, WERNER P. KOELLA (chairman) Basel, IAN OSWALD, Edinburgh, and LIVIU POPOVICIU (co-chairman), Tirgu-Mures.” (Jovanović, 1972, p. vi). This was the birth of the decision to establish a European based sleep research society to bring together researchers from the different European countries and from abroad.

Obviously the time was ripe to install formally a forum for scientific exchange between sleep researchers. Before, sleep as a topic was mainly presented in physiological and clinical (neurological and psychiatric) meetings. The envisaged society should give exposure to several aspects of sleep research and make known the field of sleep outside the people being personally involved as researchers. Thus, Prof. WERNER P. KOELLA (Basel) and his team prepared and organised the Founding Congress of a scientific society, wholly devoted to all aspects of sleep.

**The First European Congress of Sleep Research** was held in Basel, Switzerland, October 3 – 6, 1972. The late Professor W. R. HESS, the most eminent Swiss Sleep Researcher, agreed to act as the Honorary President of this First Sleep Congress. Unfortunately, due to some ailments of old age, he could not attend. The Local (Organizing) Committee included Drs K. AKERT (Zurich), A. BORBÉLY (Zurich), G. DUMERMUTH (Zurich), F. GNIERS (Brugg), W. HAEFFELI (Basel), H. HEIMANN (Zurich), P. LEVIN, (Basel, Secretary), D. M. LOEW (Basel), M. MONNIER (Basel), D. SCHNEIDER-HELMERT (Brugg), D. SCOLLO-LAVIZZARI (Basel), G. STILLE (Bern), and R. TISSOT (Geneva). As Prof. KOELLA remembers “Way over 300 researchers, professors, students and other persons interested in sleep, from all over Europe (including the countries „behind“ the Iron Curtain) but also from the Americas and the Near and the Far East attended our Congress. They all agreed: it was an excellent show, and a good and promising start into the life of ESRS.” The Scientific Program of this and the following congresses had a similar structure of Symposia with invited speakers, and Free Communications, dealing with various themes connected to the physiology, biochemistry, pharmacology and psychology, as

well as the various clinical aspects of sleep. The gathering with the most far-reaching results was evidently the Business Meeting at which about 200 of the Congress visitors participated in the founding of the now official European Sleep Research Society (ESRS). The main purpose of the newly formed Society, according to the by-laws, should be “... to promote research on sleep and related areas, to improve the care for patients with sleep disorders and to facilitate the dissemination of information regarding sleep research,” (§ 2.1). The Founding Committee guided the assembly through the various businesses, and Prof. KOELLA was elected as the first President of the ESRS. In addition to the officers, a Scientific and Publication Committee under the chairmanship of W. BAUST was established. This Founding Meeting of the ESRS was terminated with the signing up of 199 Founding Members to the new Society. Some months after the Meeting and the Congress a 525-page book – SLEEP –, edited by W. P. KOELLA and P. LEVIN, appeared, that contained all the Symposia and the Free Communications presented at the Basel Congress. As fixed in the bylaws of the ESRS (§ 13) “Scientific conferences of the society shall normally take place every second year.” This rule has been followed without any interruption. Thus, the ESRS has held twenty congresses in the 40 years of its existence.

### Purpose and structure of the ESRS

The ESRS was founded in 1972 “to promote the research on sleep and related areas in Europe, to improve the care for patients with sleep disorders and to facilitate the dissemination of information regarding sleep research.” (§ 2.1 of the original bylaws). The main instrument of the new society to serve this purpose was the organization of bi-annual congresses to present and discuss all aspects of sleep and the publication of congress proceedings.

The bodies responsible for these activities were the **ESRS Board** and the **Scientific Committee**. The Board of the society consisted of five persons (President, Vice President, Secretary, Assistant-Secretary and Treasurer). Board members were elected for two terms, i.e., four years. While in the early years of the Society the local organiser of the European Sleep Congress became Vice President for the next two years, in 1996 it was decided that the **Assembly** should also vote for the position of Vice President during the business meeting. The major task of the Scientific Committee was to support the Board in the preparation of the scientific program and to evaluate submitted abstracts and thus to secure the quality of the scientific program of the society meetings.

This limited formal structure of the ESRS, which worked well in the early years of the ESRS turned out to be insufficient to cover the increasing requirements of the ever growing sleep community in Europe. Especially the rapid development of clinical sleep research and patient care on the national level necessitated activities on the European level to coordinate the exchange of experience in training, accreditation procedures and establishment of quality control, and to harmonize procedures within Europe. Thus, step by step, the structure of the society was enlarged. For this reason ad hoc committees were appointed by the Board in 1997/98, a Clinical Committee (chaired by JEAN KRIEGER), an Educational Committee (chaired by PIERO SALZARULO), a Development Committee (chaired by YVONNE NAVELET) and finally a Committee on Sleep and Society (chaired by TORBJÖRN ÅKERSTEDT), the latter with the aim to coordinate the increasing number of National Sleep Foundations. Additional efforts were needed to enable the ESRS to act as the sole representative for all aspects of sleep research in the European level to interact with the science and health authorities of the EU.

# Historical Review of the ESRS

Although the ESRS, from the beginning, covered all aspects of sleep science (animal, human, basic, clinical and applied), the policy of the society had to be adapted with the increasing importance of sleep medicine in Europe. For this reason in 2004 the Board was “proposing to change the bylaws to emphasize that the ESRS will engage more than presently in medical aspects of sleep.” The respective changes of the bylaws were accepted by the Assembly during the congress in Prague, while at the same occasion the Assembly decided not to change the traditional name of the society. In retrospect IRENE TOBLER, then Past President summarized the result in the January 2005 Newsletter: “Although ESRS has always strived to maintain a balance between basic and clinical aspects of sleep in its congress programs, the explicit inclusion of sleep medicine was important to enhance the attractiveness of the society for the many National sleep societies in Europe. They should feel represented by the ESRS, and make use of our society to promote their interests. Without excellent basic research performed at all levels, clinical aspects shall be unable to make substantial progress. Every effort should be made by colleagues involved in sleep to promote basic research. The close interaction between clinicians and scientists of many disciplines is necessary to bring our field forward.” A close cooperation between the National Sleep Societies and the ESRS was recognized as mutually interesting for both sides to enhance the visibility of sleep science at the level of the European Union. The ESRS bylaws were amended appropriately and state now in § 2.3 that “The society will coordinate the activities of the National European Sleep Societies, and represent basic and clinical sleep research as well as sleep medicine in Europe.” These activities were implemented by a Steering Committee, chaired by JÜRGEN FISCHER. From these activities evolved later the Sleep Medicine Committee (SMC) to cope with the needs and demands of sleep medicine in Europe. Current and foreseen tasks of the SMC are (a) standards of practice papers and guidelines for clinical service, (b) certification of sleep medicine professionals, and (c) accreditation of sleep medicine centres. In order to advance these tasks the committee works with the ESRS Board and with representatives from the national sleep societies in Europe. The representatives from the national sleep societies are formally represented by delegates forming the Executive Committee of the Assembly of National Sleep Societies (ANSS). In 2006 an important change in the bylaws allowed the integration of the National Sleep Societies and their almost 5000 members as associated members of the ESRS. Finally, in 2006 a major amendment to the bylaws fixed procedures on the installation and dissolution of temporary or permanent committees. At the same time, the number of officers of the Board was raised. At present there are two Vice Presidents, one for basic, the other for clinical topics, and a Board member co-opted from the Association of National Sleep Societies (ANSS). Finally, three Advisory Members belong to the Board, namely the organizer of the previous ESRS meeting and two members-at-large, the chief editor of the Journal of Sleep Research and a member from a non-European sleep research society.

Sleep medicine as a sub-speciality, which is under development on a national level (see chapter on the National Sleep Societies), has gained excellent representation within the ESRS to shape and represent sleep medicine on a European level.

## ESRS meetings

The biannual ESRS meetings took place since 1972, prepared by the local organizers in close cooperation with the ESRS President and Board. Since 2008 the Scientific Committee is actively involved in planning and finalizing the meeting. Finally, since

2010 the organization of the ESRS meetings has been given to the professional congress organizer (PCO) Congrex.

## Prizes and awards

To promote excellence and to attract young researchers, the ESRS awards different prizes and grants. In addition, the President of the ESRS is member of the selection committee of the prestigious Pisa Award. The European Sleep Science Award has been created by the European Sleep Research Society to recognize members who have made an outstanding contribution to the field of sleep research. The recipient shall, during their career, have contributed to discoveries that significantly advanced the field. The award will be presented every two years at the Society’s scientific meeting. The choice of the awardee is made by the ESRS board together with the Scientific Committee. The European Sleep Science Award 2010 was granted to Michel Jouvét for his contributions to the definition of the fundamental principles of the field of sleep research and sleep medicine. (Table 1).

Name of the Prize, Award, or Grant	Year	Prize/Award Winner
W. R. Hess Prize	1986	Scott Campbell (San Diego, CA) and Jürgen Zulley (Munich)
Pisa Award	1994	Michael Jouvét (Lyon)
	1996	Elio Lugaresi (Bologna)
	1998	Alexander Borbély (Zurich)
	2000	David Parkes (London)
	2002	Torbjörn Åkerstedt (Stockholm)
	2004	Peretz Lavie (Haifa)
	2006	Giulio Tononi (Madison, WI)
	2008	Irene Tobler (Zurich)
ESRS Sanofi-Synthelabo European Sleep Research Grant	2010	Claudio Bassetti (Bern)
	Since 1994	Research grant for young scientists
Helgi Kristbjarnson’s Awards	Since 2004	Poster prizes
ESRS Sleep Science Award	Since 2010	Michel Jouvét (Lyon)

**W. R. Hess Prize:** The price, which was bestowed by Prof. W. P. Koella was conferred only once. The two recipients gave a Hess Price lecture on ‘Napping as a biological rhythm: disentrainment of the human sleep/wake system’ during the opening ceremony of the 8<sup>th</sup> ESRS congress.

**Pisa Award:** The award was created in 1994 due to the initiative of Prof. Luigi Murri, Pisa. The recipient of the award is selected by a committee (chaired by Prof. Murri) in which take part the president of the ESRS as well as the presidents of the Società italiana di ricerca sul sonno and of the Associazione italiana di medicina del sonno. The name of the recipient is announced at the ESRS congress and he or she gives a lecture in Pisa.

**ESRS Sanofi-Aventis Research Grants:** The grant for young scientists was first conferred during the 10<sup>th</sup> ESRS congress. The

# Historical Review of the ESRS

first recipient was Pierre Maquet. Up to 4 research grants are given per congress.

**Helgi Kristbjarnson's Awards:** Since 2004 the Icelandic Society of Sleep Medicine gives five Helgi Kristbjarnson awards the 5 best abstracts submitted to the ESRS congresses.

## Publications and media of the ESRS

Beginning with the 1972 Founding Congress, proceedings were published for each of the next 10 congresses in hard cover book format. When WERNER KOELLA implemented and edited the **Proceedings**, he had a twofold aim in mind, as he stated in the preface of the first volume: "first to offer to all of the participants a complete set of all the information disseminated during the Congress and, second, to make available to all those interested in sleep research, a selection of the latest advances in the field." Such structured and permanent information was important for the formation of the new society, and greatly contributed to make sleep visible as a new and fascinating research topic. The typical format of contributions to the Proceedings were short papers, based either on symposia contributions or free communications. While WERNER KOELLA was Editor-in-Chief of the first eight proceedings, JIM HORNE was charged to edit the next volumes of the series. The last Proceedings volume was published in 1990, containing selected contributions from the 10<sup>th</sup> ESRS Congress in Strasbourg. At that time a discussion on the suitability of the format of the Proceedings was initiated by ALEX BORBÉLY, President of the ESRS. The result of this discussion was that limitations of the Proceedings, such as bi-annual appearance, limited length of contributions became evident, and, in addition, the increasing number of contributions to the ESRS meetings required a more flexible type of publication format that would better serve the growing needs of the European sleep community. This becomes evident, when one compares the number of participants of the ESRS meeting which rose from well over 200 in the 1<sup>st</sup> meeting to 1200 in the 14<sup>th</sup> (Madrid) and 1550 in the 20<sup>th</sup> (Lisbon) meeting. Thus it was decided to stop publication of congress proceedings and to found instead the **Journal of Sleep Research (JSR)** as the major publication organ of the ESRS. The first issue of JSR appeared in 1992, twenty years after the foundation of the ESRS and eight years after the journal Sleep.

The **ESRS Newsletter** became the main vehicle for informing the membership about the activity of the Board and all ongoing activities within the ESRS between the meetings. In 2002 the Newsletter was produced electronically. The electronic Newsletter was the first step to use the new media of the digital era for timely and efficient communication within the ESRS. This first step was followed by the installation of a professional **ESRS Web site** (<http://www.esrs.eu>) with current information and an archive of the previous Newsletters and other information. A final step was reached in 2012, when the Journal of Sleep Research went fully electronic. The full use of the new media by the ESRS will deeply influence the style of communication within the network of sleep scientists in Europe.

## The relationship between the ESRS and other sleep societies

The ESRS as a continental society of sleep researchers has a position between other continental societies on the one hand and national or local societies on the other. With this in mind, different activities were initiated in the early nineties to promote relationships between the ESRS and other sleep societies. During his presidency PIER LUIGI PARMEGGIANI took the initiative, together with colleagues from the APSS, for the foundation of the World

Federation of Sleep Research Societies (WFSRS, now World Federation of Sleep Research and Sleep Medicine Societies, WFSRSMS, or World Sleep Federation, WSF) with the aim to establish exchange between continental societies and to enable international congresses with a balanced contribution of sleep researchers from different continents.

The ESRS has a formalized collaboration with the European Respiratory Society (ERS) in form of an international meeting on "Sleep and breathing". The initiative was started by Claudio Bassetti and Patrick Levy. The first meeting, which was held in Prague 2011, was attended by almost 1.000 people. The second meeting is planned for Berlin in 2013.

## Committees and networks of the ESRS

In 1996 the **Clinical Committee** published a consensus statement in the ESRS Newsletter, specifying its structure and purpose: "The Clinical Committee of the European Sleep Research Society, composed of delegates of each National Sleep Research Society, was appointed by the ESRS in order to harmonise the education in sleep physiology and pathology of sleep medicine across European countries and across medical and ancillary disciplines." The Clinical Committee was later transformed into the **Sleep Medicine Committee (SMC)** which copes with the needs and demands of sleep medicine in Europe. The SMC acts as the major link between the ESRS Board and the representatives of the national sleep societies, which are formally represented by delegates forming the Executive Committee of the **Assembly of National Sleep Societies (ANSS)**.

**Research Networking Committee.** The purpose of the committee is to coordinate European sleep research by establishing a database of ESRS Sleep Research Laboratories and Travel Awards to enable exchange of relevant information, technologies, research results and human resources.

**European Sleep disorders networks.** In recent years the ESRS has supported the establishment of patient oriented research by establishing three clinical networks, namely for narcolepsy, sleep apnea, and insomnia. The purpose of these networks is to promote research on the diseases and to improve medical care in the respective field. The networks received in 2010 and this year time slots in the ESRS meeting. The initiative was started by Claudio Bassetti and Dieter Riemann.

## Training programs of the ESRS

Training of young scientists from different fields on topics of basic and clinical sleep research is one of the major tasks of the ESRS. For this purpose in 1996 the ESRS initiated the **European Network of Sleep Laboratories (ENSTL)** which enabled young scientists or advanced students to visit experienced laboratories to learn new techniques and methodologies. In 2010 this network was replaced by the ESRS Sleep Research Laboratories database (<http://www.esrs.eu/membership-services/european-sleep-research-laboratories.html>). This database was established to enhance visibility of sleep researchers and their laboratories and promote exchange between researchers. Travel grants are currently awarded annually by the ESRS to allow young researchers to visit any of the ESRS Sleep Research Laboratories.

Sleep training courses were offered by the ESRS for the first time in connection with the 1998 Congress in Madrid, and this later became a tradition. From 2003 on the ESRS sponsored teaching courses for young clinical or experimental researchers

# Historical Review of the ESRS

independent from the bi-annual congresses. The first course was held 7 – 9 November 2003 in Munich.

The most visible and high-impact training activity of the ESRS was the 4-year (2007 – 2010) Program “Training in Sleep Research and Sleep Medicine” which was fully funded by the European Union within the “Marie Curie” Actions. The Program was finalized thanks to Thomas Pollmächer, Tarja Porkka Heiskanen, and Irene Tobler, and was coordinated by Roberto Amici with the fundamental support of Debra J. Skene and Maria Wiechmann. The Program allowed 168 young trainees from 36 countries to receive both theoretical and practical training on sleep thanks to 4 teaching courses, that were held in Bertinoro (Italy), and the activity of 11 practical training sites around Europe. Forty-three keynote speakers and more than fifty trainers were involved in the project, which culminated in the unforgettable “Final Symposium” that was held at Kloster Seeon; Bavaria, July 2010.

## **ESRS Forum for Women in Sleep Research**

The Forum, which was initiated by IRENE TOBLER, TARJA PORKKA-HEISKANEN, THERESA SAGALES, TERESA PAIVA, MYRIAM KERKHOF and EVELINE DE BRUIN got the status of a working group within the ESRS during the business meeting in Istanbul 2000. Since that time the Forum has established regular meetings at the ESRS congresses.

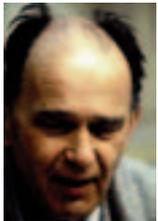
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# Historical Review of the ESRS

## The Presidents of the ESRS (1972 – 2012)

*Thomas Pollmächer  
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**Werner P. Koella**, deceased in 2008, was the founding president of the ESRS and served as president from 1972 – 1976. In the 1940s he studied neurophysiology in Zurich with the later Nobel prize laureate Walter R. Hess. From 1951 to 1968 he was for several years as a Major with the US army and later headed a NIH founded research unit at Shrewsbury, Massachusetts.

After 1968 he held the position of scientist expert at Ciba-Geigy, Basel and was actively teaching neurophysiology at the University of Bern until his retirement in 1982.

Werner P. Koella was the driving force behind the establishment of the European Sleep Research Society. He even invested his own money into the society, created the Hess price; and for many years he edited the ESRS congress proceedings.



**Pierre Passouant** (second ESRS president 1976 – 1980), deceased in 1983, was Professor of Experimental Medicine and created in 1947 the EEG and EMG laboratories at the St. Charles Hospital in Montpellier, where he and his coworkers performed polysomnographic recordings since 1958. His main areas of research were

epilepsy and narcolepsy.

Pierre Passouant co-organized the third and fourth ESRS congress in Tîrgu-Mureş (Romania) and in Amsterdam (The Netherlands). Deciding to have a congress in one of the most austere Eastern countries was not without practical and political risks. Communications between Montpellier and Tîrgu-Mureş to evaluate the quality of the facilities were quite slow and some members were opposed to have a congress in a communist country and refused to participate. As for the Amsterdam Congress it was organized “at the last minute” after the late withdrawal, for health problems, of the local organizer in Birmingham, however, it became a great success.



**Ian Oswald** (third ESRS president 1980 – 1984), deceased in 2012, was Professor of Psychiatry at the University of Edinburgh. Although the prominent topic of his own research was the pharmacology of sleep, he was interested and published in many other areas, such as the restorative functions of sleep and endocrine sleep regulation.

In 1963 he was awarded the Gaskell Gold Medal in Clinical Psychiatry of the Royal Medico-Psychological Association, and was a Foundation Fellow of the Royal College of Psychiatrists.

He co-organized the fifth and sixth ESRS congresses in Zurich (Switzerland) and Munich (Germany).



**Pier Luigi Parmeggiani** (fourth ESRS president 1984 – 1988) is Professor Emeritus of Physiology at the Medical Faculty of the University of Bologna. He received the Distinguished Scientist Award of the Sleep Research Society of U.S.A. and the Gold Medal for Science and Culture of the Italian Republic. His major research topics were

the regulation of body temperature, circulation and respiration in sleep, and the physiology of the limbic system and the cerebellum.

Pier Luigi Parmeggiani co-organized the eighth ESRS Congress in Szeged (Hungary), where the W.R. Hess Prize was awarded to Scott Campbell and Jürgen Zulley. The scientific committee was restructured, enlarged and received a chairman. He also organized the ninth ESRS congress in Jerusalem (Israel). The preparation of the congress in Israel was particularly difficult due to considerable concerns in view of the intifada at that time.



**Alexander Borbély** (fifth ESRS president 1988 – 1992) is Professor emeritus of Pharmacology at the University of Zurich. After postdoctoral training in biosignal analysis at MIT (Cambridge, Mass.) he established an animal and human sleep lab in Zurich, focusing on sleep regulation and its modeling. For his research he received

numerous awards including two honorary doctorates.

During Alexander Borbély's presidency the 10<sup>th</sup> ESRS Congress was held in Strasbourg in 1990, and two years later the 20<sup>th</sup> birthday of the Society was celebrated during the 11<sup>th</sup> ESRS Congress in Helsinki. The Young Scientists' Symposium was initiated at the 1990 congress and has since become an important part of ESRS congresses. A first meeting with the chairpersons of the National and Regional Sleep Research Societies in Europe was convened. In 1990 the Board and Scientific Committee of the ESRS approved the foundation of a new journal, the Journal of Sleep Research, and Jim Horne was appointed as the first editor. The first issue of the new journal appeared in March 1992.



**Torbjörn Åkerstedt** (sixth ESRS president 1992 – 1996) is Professor of Behavioral Medicine and director of the Stress Research Institute, Stockholm University (affiliated to the Karolinska Institute). His major research activities are related to stress and work hours, sleep regulation, and sleepiness in driving.

He co-organized the 12<sup>th</sup> and 13<sup>th</sup> ESRS congresses in 1994 (Firenze) and 1996 (Brussels). One major event during Torbjörn Åkerstedt's presidency was the launching of the Journal of Sleep Research, which had, of course been prepared by the previous board. When he was president, an extensive revision of the ESRS bylaws, leading to more membership participation in the board elections, was performed, and the first European countries started to found national sleep societies.

# Historical Review of the ESRS



**Michel Billiard** (seventh ESRS president 1996–2000) is Professor emeritus of Neurology at the University of Montpellier. Before, he was head of the department of Neurology at the Gui de Chauliac Hospital. He developed the earlier small sleep unit in Montpellier to a large sleep disorders center. His major scientific interests are hypersomnias of central origin.

Michel Billiard co-organized the 14<sup>th</sup> ESRS congress in Madrid and the 15<sup>th</sup> ESRS congress in Istanbul (2000). During his presidency ESRS went online with the first home page of the Society (March 1997). At the occasion of the 25<sup>th</sup> Anniversary a booklet *ESRS 1972 – 1997* was compiled. The ESRS was officially registered as a non-profit organization according to German law in Regensburg and teaching sessions were for the first time implemented during the congress in Istanbul.



**Irene Tobler** (eighth ESRS president 2000 – 2004) is Professor emerita of Zoology at the University of Zurich. She headed there the Section Animal Sleep of the Institute of Pharmacology. She graduated in Biology and joined the laboratory of Alexander Borbély in 1975. Her major research topic is sleep regulation in animals. Her main interest is comparative behavior and physiology of

sleep as well as phylogeny of sleep, studying sleep in more than 20 species. These included invertebrates such as cockroaches and scorpions, in which she identified a mammalian-like homeostatic aspect of sleep regulation. During Irene Tobler's presidency the 16<sup>th</sup> and 17<sup>th</sup> ESRS Congress were held in Iceland and in Prague. The 17<sup>th</sup> congress was the first where ESRS could profit from the revenues enabling the board to carry administrative costs and support teaching and education. During a meeting with the presidents of the National Societies and the ESRS board in Mallorca in 2004 a steering committee was founded to initiate the process of integrating National Sleep Societies into ESRS. A first program for young sleep scientists was made possible by an unrestricted educational grant from industry, resulting in three highly successful courses.



**Thomas Pollmächer** (ninth ESRS president 2004 – 2008) is Professor of Psychiatry at the Ludwig-Maximilian University Munich and Director of the Center of Mental Health, Klinikum Ingolstadt, Germany. He had his university and medical training in Freiburg and Munich, and he headed the human sleep research group at the Max Planck

Institute of Psychiatry until he moved to Ingolstadt in 2004. His major research topics are sleep in psychiatric disorders, and metabolic and immunological aspects of sleep.

Thomas Pollmächer co-organized the 18<sup>th</sup> and the 19<sup>th</sup> ESRS congress in Innsbruck and Glasgow. He designed the new bylaws including the Assembly of National Sleep Societies as an integral body into ESRS and he headed a big EU funded educational Marie Curie program providing intensive one-week teaching courses to 160 students Europe wide during 4 years.



**Claudio Bassetti** (tenth ESRS president, 2008 – 2012) is Professor of Neurology and Director of the Department of Neurology at the University Hospital in Bern, Switzerland. In the past, he headed the sleep center in Bern (1992 – 2001), and established clinical and experimental sleep laboratories in the neurology departments of Zürich (2001 – 2009) and Lugano (2009 – 2012).

He is current president of the Swiss Neurological Society and president-elect of the European Neurological Society (ENS).

His major research topics are sleep in neurological disorders, narcolepsy, and stroke.

He was awarded the 2010 Pisa Sleep Award.

Claudio Bassetti co-organized the 20<sup>th</sup> and the 21<sup>th</sup> ESRS congress in Lisbon and Paris, where the ESRS Sleep Research Award was given for the first two times. He professionalized the organization of the society, fostered the development of ESRS sleep medicine curricula and certifications, supported the activities of continental research networks, enhanced the involvement of the scientific committee in the organization of the ESRS meeting, strengthened the links with other professional Societies (co-organizing the first two meetings with the European Respiratory Society), and edited the ESRS 40<sup>th</sup> anniversary book.

# Historical Review of the ESRS

## ESRS Congresses

*Michel Billiard*

*Department of Neurology, Gui de Chauliac Hospital,  
Montpellier, France*

The history of European Congresses of Sleep Research goes back to a sleep symposium in Würzburg (Germany), 1971, where a "founding Committee" including Drs. Baust, Gottesmann, Jovanović, Koella (chairman), Oswald and Popoviciu was established.

One year later the 1<sup>st</sup> European Congress of Sleep Research took place in Basel (Oct 3 – 6, 1972) under the chairmanship of Prof. Werner P. Koella. Over 300 researchers, clinicians and other persons interested in sleep, from all over Europe, including countries behind the "iron curtain", North and Latin America, Near and Far East attended the Congress, and it was a great success. On October 4<sup>th</sup>, at the Business Meeting, the European Sleep research Society (ESRS) was founded and agreed that "the ESRS shall organize a Scientific Congress every other year". From 1972 on, a congress was organized every other year without exception.

### The preparation of the Congress

The initial meetings were entirely under the responsibility of the local organizer communicating with the President. Subsequently, step by step, the scientific organization of the Congress was transferred to the board and the scientific committee.

Preparation of the congresses happened to be more than problematic in some cases. The 4<sup>th</sup> Congress in Tirgu-Mures (Romania), the first one to be held in an eastern country, had to face logistic and political issues. On the logistic side it was difficult to evaluate the facilities that would be available for the scientific sessions and the accommodation for delegates. On the political side some members were opposed to have a Congress in a communist country and refused to attend. Of note, Michel Jouviet was quite critical of the regime at the opening ceremony and a team conducted by J. L. Valatx, from Lyon, asked and obtained permission to visit political prisoners during the Congress.

The next Congress, initially decided to be held in Birmingham, was a nightmare for Pierre Passouant. For many months he received no answers to his letters, until eventually the local organizer threw in the sponge and announced he was not able to organize the Congress. As an emergency measure, Pierre Passouant contacted Piet Visser from Amsterdam, who after a week's reflection, very elegantly accepted the challenge.

Another issue concerned the preparation of the 9<sup>th</sup> Congress in Jerusalem. About a year before the planned time of the Congress, letters were sent to members of the Society suggesting a change to the Congress venue, because of the political situation in Israel. Nevertheless, it went ahead as planned, and with weeks of insomnia for the local organizer.

Twelve years later the same scenario occurred for the Istanbul Congress. A petition was submitted to the Board of the Society, requesting a postal ballot over postponing the congress due to violations of human rights in Turkey. Again, the Congress was able to go ahead as planned, but only after weeks of turmoil for the President and the local organizers.

Starting with the 20<sup>th</sup> Meeting in Lisbon the organization of the bi-annual meeting has been coordinated by the PCO of the society (Congrex).

### The Congress

#### The opening ceremony and the guest lectures

Each congress starts with an opening ceremony attended by local political and scientific authorities. I must mention that the 16<sup>th</sup>

Congress in Reykjavik was opened by the President of Iceland, Ólafur Ragnar Grímsson and the 17<sup>th</sup> Congress in Prague by the Mayor of Prague, Pavel Bém, M.D. Usually, guest lectures by famous local people are also organized and I'd like to cite two of them: "Dream and Reality" by Prof Ilkka Niiniluoto, Professor of theoretical philosophy at the University of Helsinki. The other was a history of a diverse collection of "lullabies" by Cihat Askin, a Turkish violinist with an unusually rich and varied background, who then interpreted some lullabies with the help of two other musicians.

Starting in Lisbon the opening ceremony has included, in addition to the traditional young investigators symposium, also the award ceremony for the ESRS Sleep Research Prize.

#### The scientific program

The program of the 1<sup>st</sup> Congress in Basel included 5 symposia with invited speakers. Since then, various features have been progressively added to the programme. The first one was a special lecture at the Tirgu-Mures Congress (1978), followed by what have been special lectures or state of the art lectures in later Congresses.

A second initiative was the introduction of a "Young Scientist Symposium" taking place after the opening ceremony, in which five "new blood" researchers who have recently finished or are about to finish their doctorate, present their data. The first was organized in Strasbourg (1990). Then came Teaching Courses in Istanbul (2000), clinical case presentations and video sessions in Prague (2004), debate sessions in Innsbruck (2006) and "meet the professor sessions" in Lisbon (2010).

Another successful initiative was the introduction of satellite symposia including the European Society of Sleep Technologists (ESST) since the Helsinki Congress, the European (Pediatric) Sleep Club and the ESRS Forum for Women in Sleep Research since the Madrid Congress.

Meetings of the National Sleep Societies began at the Florence Congress (1994) with a further stimulus to these by Irene Tobler, starting in 2000.

Finally, the Lisbon Congress was the occasion of four European Sleep Network Sessions (on sleep apnea, narcolepsy, insomnia and restless legs syndrome).

#### Business meeting

This is a key time of each Congress. It includes the acceptance of the Minutes of the previous Business Meeting, the reports of the President, Secretary, Assistant-Secretary, Vice-President (Basic), Vice President (Clinical), Treasurer, the report of the Assembly of National Sleep Societies, the report of the Journal of Sleep Research's editor, the election of the members of the Board of officers, the election of the Scientific Committee, and voting for the location of the next conference but one (i.e. four years ahead).

#### Social programs

It is absolutely impossible to cite all the great time we had in the different Congresses. Let me recall: the semi-formal banquet on a large river-boat in Basel, the memorable "mechoui" prepared on the lawn of an old mansion along the river Lez in Montpellier, the boat trip on the Amsterdam canals to the Institute Maison Descartes, the candle light dinner with music in the main building of the University of Zurich, the superb walk in the Alps at the Munich Congress, the Csarda-party in a traditional inn, on the bank of the river Tisza in Szeged, the sound and light show at the Tower of David in Jerusalem's old city, the evening wine tour in Alsatian villages, the banquet at Castillo de Verrazzano, a XV century castle in the famous Chianti region at the Florence

# Historical Review of the ESRS

Congress, the welcome receptions at the Comic Strip Museum in Brussels, at the Railway Museum in Madrid and in the Esma Sultan Mansion on the Bosphorus in Istanbul, the adventurous rafting on a river with an optional 10 meter high jump in the water in Iceland, the party in the Pantheon of the National Museum of Prague, one of the most celebrated secular halls of the Czech architecture, the opening ceremony led by the Scottish folk-rock band Skerryvore at a ceilidh on the former Renfrew Ferry in Glasgow and the welcome reception with a traditional show of the group of dance from the North of Portugal in Lisbon.

## Soccer

One of the main non-scientific events of ESRS Congresses has been the soccer match between Italy and the rest of the world,

initially inspired from the soccer match which took place at the International APSS Congress in Bologna (1983). The very first was scheduled during the Munich Congress (1984), but due to heavy rain it had to be cancelled. Eventually, it took place in Szeged (1986) where one of the player's arms was broken. At the Helsinki Congress Alexander Borbély made a spectacular save as a goal keeper, but broke two fingers. In Prague the usual Italy against the rest of the world was replaced by a North-South contest and in Lisbon by Portugal against the rest of the World.

Below is a summary of ESRS Congresses from the very beginning in Basel to the last one in Lisbon. Now, we begin the journey of the next 10 years of the ESRS Congresses when the 50<sup>th</sup> anniversary of the Society will be celebrated – bon voyage!

Number	Location	Dates	President of the ESRS	Chairman of the organizing committee	Number of delegates
1 <sup>st</sup>	Basel, Switzerland	Oct 3 – 6, 1972	Werner P. Koella	–	approx. 300
2 <sup>nd</sup>	Rome, Italy	Apr 8 – 11, 1974	Werner P. Koella	Mario Bertini	?
3 <sup>rd</sup>	Montpellier, France	Sep 6 – 10, 1976	Werner P. Koella	Pierre Passouant	approx. 300
4 <sup>th</sup>	Tirgu-Mures, Romania	Sep 11 – 15, 1978	Pierre Passouant	Liviu Popoviciu	?
5 <sup>th</sup>	Amsterdam, The Netherlands	Sep 2 – 5, 1980	Pierre Passouant	Piet Visser	approx. 300
6 <sup>th</sup>	Zurich, Switzerland	Mar 23 – 26, 1982	Ian Oswald	Alexander Borbély	?
7 <sup>th</sup>	Munich, Germany	Sep 6 – 9 1984	Ian Oswald	Eckart Rütther	?
8 <sup>th</sup>	Szeged, Hungary	Sep 1 – 5, 1986	Pier-Luigi Parmeggiani	Ferenc Obal	420
9 <sup>th</sup>	Jerusalem, Israel	Sep 5 – 9, 1988	Pier-Luigi Parmeggiani	Peretz Lavie	325
10 <sup>th</sup>	Strasbourg, France	May 20 – 25, 1990	Alexander Borbély	Daniel Kurtz	1114
11 <sup>th</sup>	Helsinki, Finland	Jul 5 – 10, 1992	Alexander Borbély	Markku Partinen	approx. 700
12 <sup>th</sup>	Florence, Italy	May 22 – 27, 1994	Torbjörn Åkerstedt	Piero Salzarulo	850
13 <sup>th</sup>	Brussels, Belgium	Jun 16 – 21, 1996	Torbjörn Åkerstedt	Myriam Kerkhofs	802
14 <sup>th</sup>	Madrid, Spain	Sep 9 – 12, 1998	Michel Billiard	Antonio Vela-Bueno	approx. 1200
15 <sup>th</sup>	Istanbul, Turkey	Sep 12 – 16, 2000	Michel Billiard	Erbil Gozukirmizi Hakan Kaynak	approx. 800
16 <sup>th</sup>	Reykjavik, Iceland	Jun 3 – 7, 2002	Irene Tobler	Thorarinn Gislason	783
17 <sup>th</sup>	Prague, Czech Republic	Oct 5 – 9, 2004	Irene Tobler	Sona Nevsimalova	approx. 1300
18 <sup>th</sup>	Innsbruck, Austria	Sep 12 – 16, 2006	Thomas Pollmächer	Birgit Högl Werner Poewe	approx. 1200
19 <sup>th</sup>	Glasgow, Scotland	Sep 9 – 13, 2008	Thomas Pollmächer	Colin Espie	1430
20 <sup>th</sup>	Lisbon, Portugal	Sep 14 – 18, 2010	Claudio Bassetti	Teresa Paiva	1552
21 <sup>st</sup>	Paris, France	Sep 4 – 8, 2012	Claudio Bassetti	Jean-Louis Pépin	yet unknown

## History of the Journal of Sleep Research (JSR)

Jim Horne<sup>1</sup>, Peretz Lavie<sup>2</sup> and Derk-Jan Dijk<sup>3</sup>

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<sup>2</sup>Technion-Israel Institute of Technology

<sup>3</sup>University of Surrey UK

**Jim Horne: 1990 – 2008** Under the ESRS presidency of Alexander Borbély, the Journal of Sleep Research officially came into being at an ESRS Board meeting, held early December 1990. Until then, the only official publications for Society were the biannual books ('SLEEP 1976' – onwards) containing selected papers from ESRS conferences. The idea for establishing the Journal had been around for some time beforehand, and a survey of ESRS members (who would be expected to subscribe) had been positive. However, following news that the journal 'Sleep' was expanding into Europe and wanting to recruit Alexander B. as European Editor, Alex called a meeting, in Zurich, on 17<sup>th</sup> November with representatives of national sleep societies, to discuss the establishment of our Journal. An account of this meeting in the December 1990 ESRS Newsletter, describes the 6h session as "animated and amicable", eventually resulting in a ratio of 3:1 majority vote to immediately go ahead with the Journal. Its emphasis was to be on basic and experimental research, so as not to compete too directly with the journal 'Sleep' but, nevertheless, ours had to be an international journal reaching the USA, for example, and with vigorous peer review. Jim Horne, then the current editor of the SLEEP books, was invited to be Editor-in-Chief of JSR, with the following invited (and appointed) as Associate Editors able to cover a wide spectrum of expertise, and to be responsible for handling submitted papers in their specialist areas: Joelle Adrien, Torbjorn Åkerstedt, Alexander Borbély, David Parkes, Pier Luigi Parmeggiani, Markku Partinen, Hartmut Schulz, Irene Tobler and Rudi Van den Hoofdakker. Michel Jouviet agreed to be Honorary Editor, and an Advisory Board was established with representatives from many countries within and beyond Europe. The SLEEP books would discontinue.

A publisher had to be found who would allow the ESRS to retain the Journal's copyright, as thus make the Society the Journal's owner. However, this proved difficult as the norm was for the publisher to retain copyright. A publisher who originally agreed, suddenly changed their mind, and now wanting sole rights. Luckily, Blackwells Science soon stepped in and agreed to our terms, and the contract was signed on 3<sup>rd</sup> April 1991. They have remained with us, although, having more recently been taken over by Wiley International to form Wiley-Blackwell.

That year (1991) the Editor and Associate Editors worked closely as a team on many aspects of the Journal's foundation. Our first Editorial Board meeting was in Amsterdam, on 29<sup>th</sup> April 1991, where we finalised specifications for the types of manuscripts instructions to authors, the design and colour of JSR's cover, and the logo. In fact, we spent more time deliberating over JSR's logo than anything else on that day, as everyone had their own ideas. Eventually, we decided on a woodcut by Camille Flammarion (1882) – as shown, which is a copy of an earlier original by the Durer school. In a rather light-hearted manner, we thought it symbolised the struggling sleep researcher, dressed in a night-shirt, slippers and bed-hat, making a breakthrough in the understanding of the influence of daylight and darkness (sun and moon) on circadian (wheel-like) aspects of sleep (there is a sort of hypnogram being

grasped). If one looks closely at the upper left side of the picture, there is even something that distinctly resembles the discharge pattern of burst cells in REM sleep. On the other hand, one might think, as Dürer did, that it depicts "Der neue Mensch durchbricht die begrenzte Welt des ptolemäischen Universums und erblickt neue Wunder" ('the new man breaks through the limited world of the ptolemaic universe and perceives new wonders').



Together with the ESRS Board, difficult decisions had to be made, especially the need for a compulsory inclusion of JSR's subscription into ESRS membership dues. A call for papers went out with the June 1991 ESRS newsletter, which was soon followed by an agreeably surprising and very encouraging response, that enabled an impressive portfolio of excellent papers to be accepted (the very first paper accepted was by Bunnell et al.); quite sufficient for the 1992 launch. Issue 1 appeared that March, and followed by the quarterly issues. The first supplement soon followed, in June 1992, comprising the abstracts of the ESRS Helsinki Congress.

To encourage ESRS members to take up an initial subscription to JSR, we made this 'painless' by combining it within a 'discounted early registration' for the Helsinki Congress, and obtained 459 early subscriptions, which was excellent. Thereafter the subscription was added to the annual dues; a manoeuvre that seemed not to deter ESRS membership.

The next milestone was to be listed in Current Contents (January 1994) and, more importantly, in what was then Index Medicus, when we were listed there in March 1995, which was almost a record for a new journal, given their strict criteria. Pre-publication electronic versions of JSR became available in 2004. In 2005, our publishers requested that we went over to an entirely electronic MSS submission and management system, handled by Manuscript Central. But this had many teething problems. Even when these were sorted out, this sophisticated and rather complex system did not result in any real improvement of the handling of MSS, compared with our own well developed, more flexible and simpler electronic system, which had worked very well! New Associate Editors came in as others retired, and we welcomed Claudio Bassetti, Chris Gillin and John Stradling. Sadly Chris died in 2003, and was irreplaceable. Jim retired as Editor in 2008, when Peretz Lavie took over.

# Historical Review of the ESRS

**2008 – 2010: Peretz Lavie** succeeded Jim Horne as the chief editor of JSR. He assumed his position on January 2008 starting his editorial responsibility with the first issue of Volume 17. The journal's standing at that time was one of the top 10 behavioural science journals and one of the top 25 physiology journals. However, the competition to win the heart of sleep researchers has grown fast during that period with no less than six journals dedicated exclusively to sleep and sleep disorders. In 2007, the five sleep journals listed on the Web of Knowledge published 354 papers, but the term 'sleep' appeared in the title of additional 1200(!) papers published in a variety of other journals. To accommodate the growing scope of sleep research and to allow a better representation of the broad spectrum of sleep research, Lavie increased the number of associate editors to 16. He also made some changes in the journal's appearance and in the guidelines to authors aimed at improving the journal and making it more attractive to readers and submitters alike. In addition, to shorten the lag time between a paper's acceptance and publication, he instituted online early publications that were available as soon as they were ready, rather than having to wait for the next scheduled print issue. However, Lavie's period as Editor in Chief lasted only 2 years. On March 2010 (Vol. 19, issue 1, p. 2) in his editorial "Farewell from the chief editor" he announced his resignation from the position of Chief editor because of his election to the very demanding position of the president of the Technion – Israel Institute of Technology, and he passed the editorial responsibilities to Derk-Jan Dijk.

**Derk-Jan Dijk: 2010 – :** The expectations of authors and the ESRS membership have evolved considerably since the 1990's and JSR has attempted to keep up with these expectations. Derk-Jan appointed Patrick Levy, Colin Espie, Mehdi Tafti, Pierre-Hervé Luppi, Pierre Maquet, Nathaniel Marshall and Torbjorn Åkerstedt, as Deputy Editors. Current Associate Editors are Claudio Bassetti, Tom de Boer, Michael Bonnet, Jan Born, Christian Cajochen, Jan Hedner, Luigi de Gennaro, Damien Leger, Thomas Pollmacher, Tarja Porkka-Heiskanen, Renata Riha, Avid Sadeh, Debra Skene, Karine Spiegel, and Luci Wiggs. The Deputy and Associate Editors reflect the very broad range of research areas covered in the articles published in JSR. The large editorial board also reflects the changing landscape of sleep research. Many members of ESRS are active in sleep medicine in Europe and abroad and many research articles related to sleep medicine are submitted to JSR. JSR is the journal of the ESRS and the publications in JSR should reflect the research activities of the society. This continues to include basic animal, basic human and sleep medicine research.

The expectations of authors have changed considerably as well. Who wants to wait three months for a referee report? Is it efficient use of the time of our reviewers if it is very clear that the quality of a manuscript is well below the threshold for JSR? The Deputy Editors play an important role in speeding up the decision process and together with the Editor handle the majority of submissions without involvement of Reviewers, whose time and efforts devoted to JSR are gratefully acknowledged. Throughout many years of JSR Inga Whitehouse and Brigitte Knobl have been key contributors to the professional service of JSR to its Authors, Reviewers and Editorial Board.

The publishing process itself has changed. Is there still a need for a printed version of the Journal? As of 2012, JSR is published on-line only. This led to a considerable reduction of the publishing cost and also makes it possible to publish colour figures without additional costs. Issues are still compiled and announced to the

ESRS membership and subscribers via email. Sleep research remains a popular area for publishers and the competition among Sleep Journals is considerable and healthy. The sleep researcher can choose from many sleep journals. Impact factors are a main driver of submission behaviour. The impact factor of JSR is healthy with a current 5-year impact factor of 3.7 but many ESRS members may first submit to a higher impact journal and wait and see. Other changes are on the horizon. Many funding organisations of research now expect their research to be accessible for free to anyone in the world. Open Access journals are on the rise. Authors have to pay for this open access and also JSR offers authors to buy open access. How the Open Access movement will change the sleep journals and publishing behaviour of our members, remains to be seen.

These changes will, however, not fundamentally affect the nature of JSR. It is a journal of the European Sleep Research Society. It reaches out to sleep scientists all over the world, but will also keep at distinctive European touch. JSR is and will remain our home ground.

## Pictures of the Past and Present of Sleep Research and Sleep Medicine in Europe

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It is said that a picture is worth a thousand words, and following a call to senior members of the ESRS for photographic and other visual memorabilia that give a flavour of sleep research in Europe over the last 40 years, we received a variety of fascinating material, and would like to thank all the contributors.



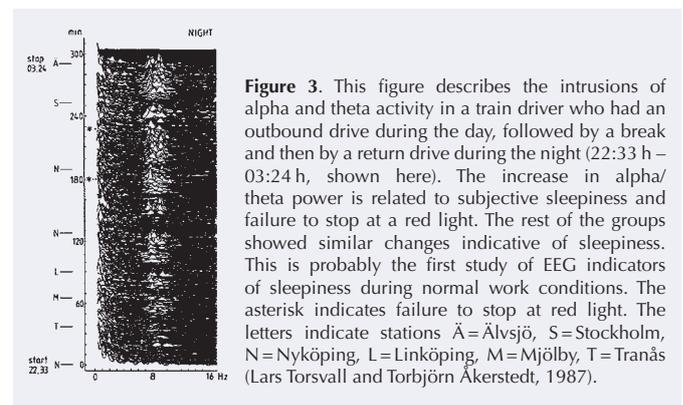
**Figure 1.** Mario Bertini in his sleep laboratory in 1974. On the occasion of the 2<sup>nd</sup> Sleep Research Congress that he had organized in Rome at that time, he was interviewed and photographed by a popular magazine.

### Technology

We begin by reflecting the dramatic advancement in measurement technology, starting with a press cutting (Fig. 1) from 1974 showing the solitary researcher (Mario Bertini) surrounded by the sophisticated equipment of the day, with him pointing rather

forlornly at the impending reams of paper being disgorged from his polygraph, that will confront him next morning. Contrast this with today's brain imaging facilities seen in the pastiche provided by Pierre Maquet and his colleagues (Fig. 2), showing: (A) intense activity in limbic and paralimbic areas during REM sleep; (B) combined EEG and fMRI in nonREM slow waves and spindles; (C) areas recruited during motor learning that are also active during post-learning REM sleep, and brain areas linked to topographical memory (including the hippocampus) again active during subsequent NREM sleep; (D) the influence of non-classical photoreception on regional brain activity, during night and day; (E) individual vulnerability to sleep loss predicted by the PER3 VNTR polymorphism; and finally (F), individual 'lark-owl' differences in the recruitment of hypothalamic and midbrain areas that maintain evening alertness.

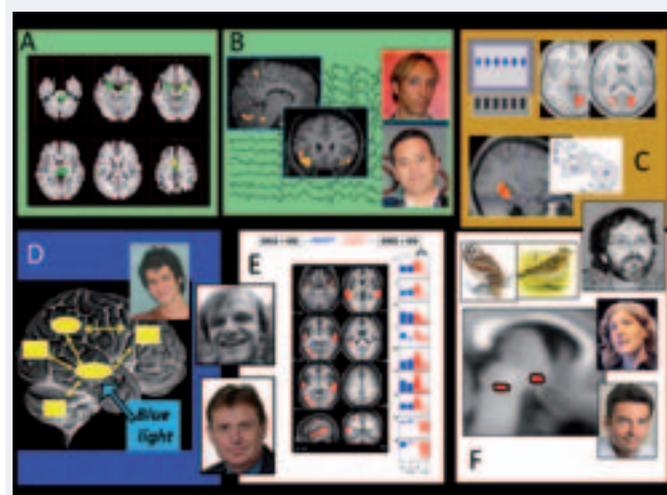
Other developments, in microelectronics, enable portable EEG recordings in the field, to be seen in the example from Torbjörn Åkerstedt's laboratory (Fig. 3), of compressed EEG spectra obtained from sleepy train drivers. The increase in alpha/theta power is related to subjective sleepiness and failure to stop at a red light.



**Figure 3.** This figure describes the intrusions of alpha and theta activity in a train driver who had an outbound drive during the day, followed by a break and then by a return drive during the night (22:33 h – 03:24 h, shown here). The increase in alpha/theta power is related to subjective sleepiness and failure to stop at a red light. The rest of the groups showed similar changes indicative of sleepiness. This is probably the first study of EEG indicators of sleepiness during normal work conditions. The asterisk indicates failure to stop at red light. The letters indicate stations: A=Älvsjö, S=Stockholm, N=Nyköping, L=Linköping, M=Mjölby, T=Tranås (Lars Torsvall and Torbjörn Åkerstedt, 1987).

### Models

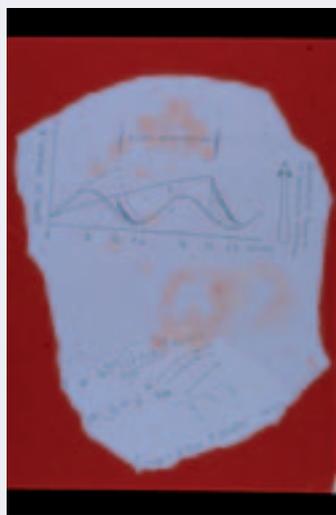
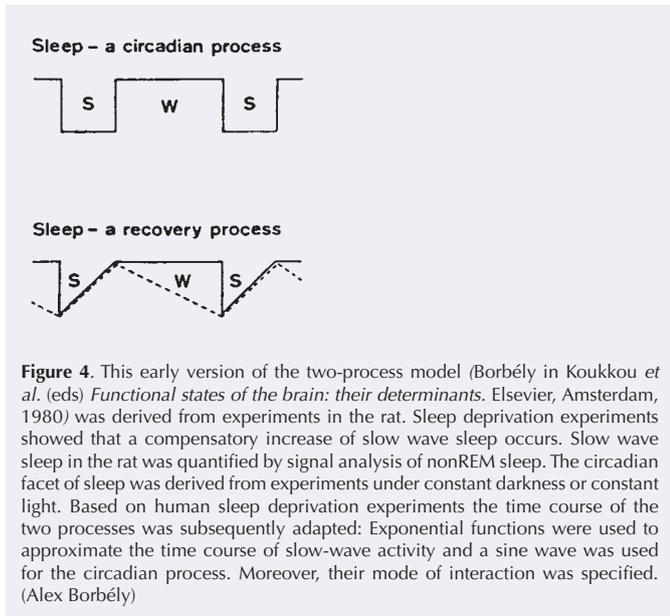
The understanding of the interactions between sleep and circadian rhythms in both animals and humans has evolved from a simple concept (Fig. 4) inspired by Alex Borbély and colleagues, which has developed into their sophisticated, interactive 'Two process Model', whereby its sleep component (Process S) focuses on the exponential nature of slow wave EEG activity. Anna Wirz-Justice has supplied a photo (Fig. 5) taken in a restaurant around 1980,



**Figure 2.** We applied functional neuroimaging in normal volunteers to better understand human sleep and sleep/wakefulness regulation. A. Using positron emission tomography (PET) and radiolabeled water, we reported the functional neuroanatomy of REM sleep, characterized by an intense activity in limbic and paralimbic areas. B. Using simultaneous EEG and functional magnetic resonance imaging (fMRI), Manuel Schabus and Thanh Dang-Vu showed that NREM sleep was also associated with consistent brain activity, synchronized by slow waves and spindles. C. Philippe Peigneux observed that brain areas recruited during motor learning were also active during post-learning REM sleep (first row). Similarly, brain areas engaged in topographical memory, including the hippocampus, were again active during subsequent NREM sleep, in proportion to the overnight gain in spatial performance (second row). D. Fabien Perrin, Gilles Vandewalle and Derk-Jan Dijk explored the influence of non-classical photoreception on regional brain function, both during night time and daytime. E. Gilles Vandewalle and Derk-Jan Dijk capitalized on the individual vulnerability to sleep loss predicted by the PER3 VNTR polymorphism to characterize the influence of circadian, sleep homeostasis and their interaction on cognitive responses. F. Christina Schmidt, Christian Cajochen and Philippe Peigneux resorted to individual differences in diurnal preference to show that evening and morning chronotypes do not recruit hypothalamic and midbrain areas to the same extent to maintain alertness in the evening, due to the interaction between circadian and homeostatic factors. (Pierre Maquet)

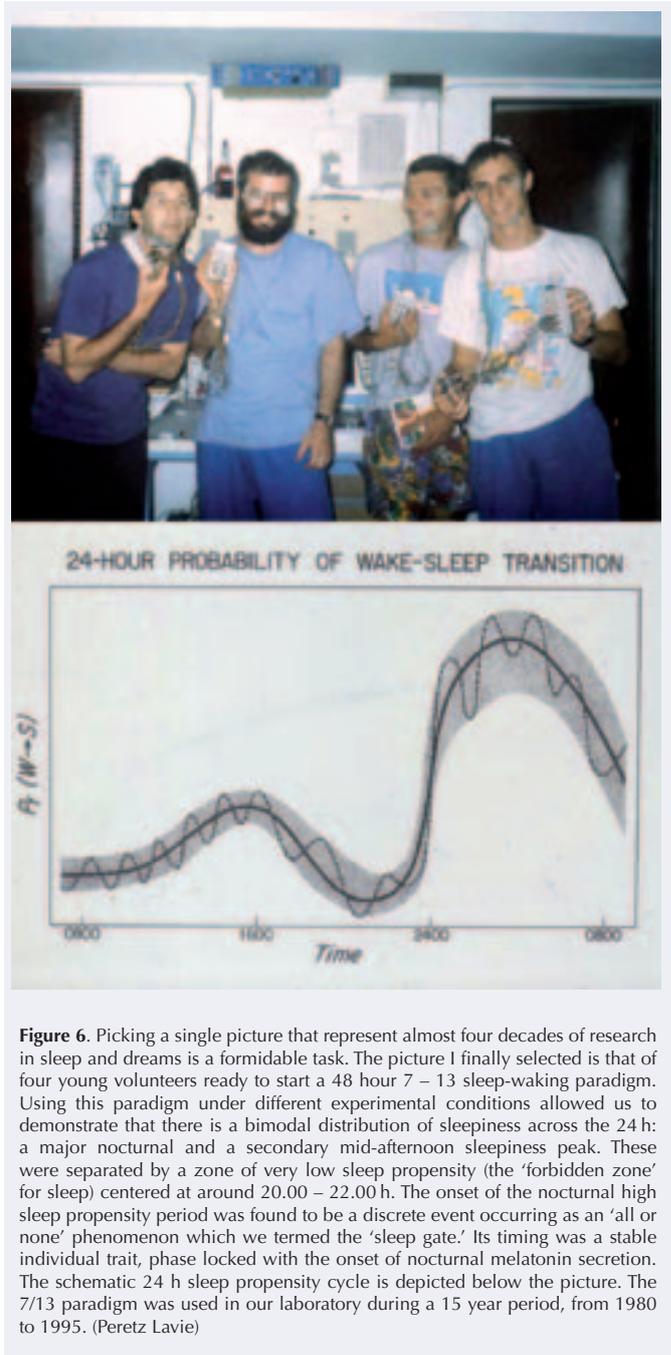
# Historical Review of the ESRS

of a piece of torn paper tablecloth (complete with wine-glass stains), showing the first draft of her paper (with Alex) attempting to apply the Model to the improvement of depressive symptoms after a night's sleep deprivation. Thirty years later, and somewhat poignantly, she notes, "we still don't understand this rapid clinical response".



**Figure 5.** This piece of torn paper tablecloth with wine-glass stains from a restaurant sometime around 1980, documents the first draft of a paper attempting to apply the two-process model of sleep regulation to understand why depressive symptoms improve after a night's sleep deprivation. The model has served as a template for conceptualising abnormalities in the circadian pacemaker (amplitude, phase, period) as well as in the sleep homeostat. Thirty years later, we still don't understand the phenomenon of rapid clinical response, and the S-deficiency hypothesis has not yet been refuted. (Anna Wirz-Justice)

Peretz Lavie's picture (Fig. 6) from the early 1980's shows four volunteers ready to start a 48 hour, 7 – 13 h sleep-waking paradigm, that led his group to describe the circadian 'forbidden zone' for sleep, seen at around 20 – 22 h, followed by the 'sleep gate'. With colleagues he saw the gate as a stable individual trait, phase locked with the onset of nocturnal melatonin secretion. Their schematic 24h sleep propensity cycle is seen below the picture.



## Basic Research

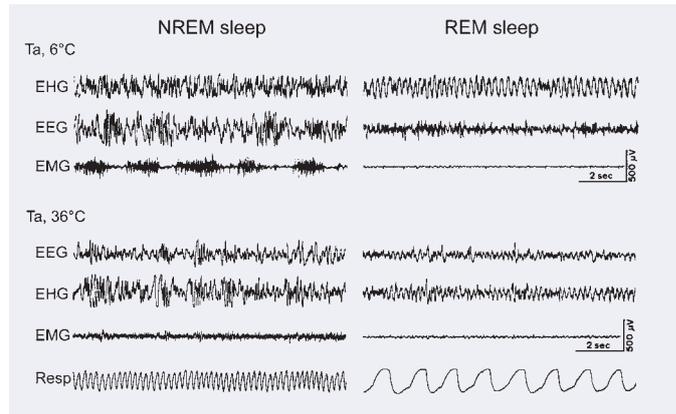
Irene Tobler's pastiche (Fig. 7) of her group's studies of 'use-dependent' sleep EEGs, replicates in animals earlier human studies by her colleagues, whereby unilateral hand stimulation led to localised sleep EEG changes in the following night's sleep. In her rats, seen here, whiskers were removed from one side of an animal's snout, leaving those whiskers on the other side to experience a variety of waking novel stimulation. The brain slice image shows more neural activity in the contralateral side during wakefulness. Subsequently, there is greater sleep EEG activity from the associated, localised cortical 'barrel fields' sensitive to the stimulation of the remaining whiskers.

Over many years Pier Luigi Parmeggiani's laboratory has been measuring in his cats thermoregulation in (mostly REM) sleep. At low environmental temperatures, shivering is evident in neck

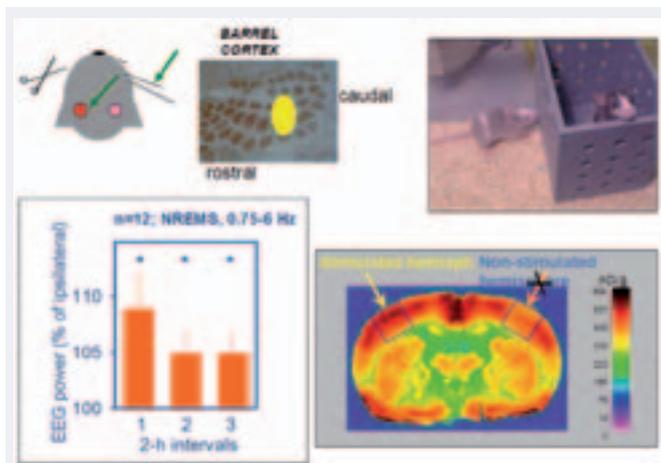
# Historical Review of the ESRS

muscle EMGs during NREM sleep, but absent in REM. On the other hand, at high temperatures panting is seen in NREM but absent in REM. These sleep state differences, seen in Fig. 8, have led the group to describe REM as ‘poikilostatic’ in terms of its poorer ability to thermoregulate, contrasting with the usual homeostatic regulation during the states of NREM sleep and wakefulness.

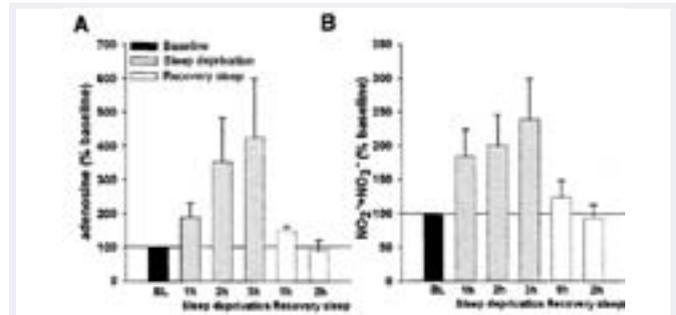
Over the last 10 years or so, Tarja Porkka-Heiskanen’s laboratory has investigated, in the animal basal forebrain, the roles of adenosine and nitric oxide for sleep regulation. Their having developed delicate microdialysis techniques, these investigators have shown, as in Fig. 9, increasing concentrations of both substances in rats during sleep deprivation, that decline rapidly during recovery sleep. Such contrasting changes seem to reflect alterations in energy balance.



**Figure 8.** Shivering and panting during sleep. At low environmental temperature (6°C), shivering is evident in the neck muscle electromyogram during NREM sleep and absent during the subsequent REM sleep episode. At high environmental temperature (36°C), panting is present during NREM sleep and absent during the subsequent REM sleep episode. Ta, environmental temperature; EHG, electrohippocampogram; EEG, electroencephalogram; EMG, electromyogram; Resp, breathing movements. (Modified from Parmeggiani, P. L., and Rabini, C. *Brain Res.*, 1967, 6:789-791.) For the first time, this study demonstrated an interruption of the temperature regulation during sleep and provided a good reason to explore from the viewpoint of Cannon’s principle of homeostasis the regulation not only of temperature but also of respiration and circulation, physiological functions that are also involved in temperature regulation. On the basis of the experimental results, NREM sleep and REM sleep consistently deserve the general designations of “homeostatic” (due to integrated physiological functions) and “poikilostatic” (due to disintegrated physiological functions), respectively. Homeostasis and poikilostasis are physiological states resulting from intrinsic changes in the functional organization of the central nervous system. (For a recent overview of the experimental contributions underlying this conclusion, see: P. L. Parmeggiani. *Systemic Homeostasis and Poikilostasis in Sleep: Is REM Sleep a Physiological Paradox?* Imperial College Press, 2011). (Pier Luigi Parmeggiani)



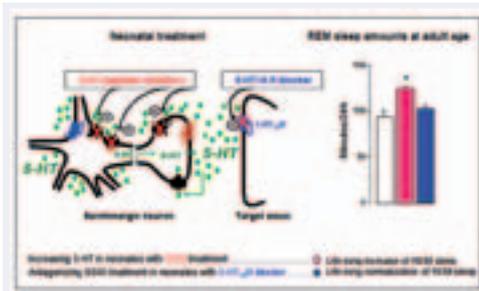
**Figure 7.** Unilateral whisker stimulation in mice and rats. Alexander Borbély had tested the hypothesis of “use-dependent” sleep in a unilateral hand stimulation experiment in 1994 (Kattler *et al.*, *J. Sleep Res.*, 1994). Searching for an animal model to pursue this avenue, I had discussed with Professor Henri van der Loos from the University of Lausanne the usefulness of his mouse “whisker model”; the exquisite representation of every whisker in the barrel field of the contralateral hemisphere looked promising to perhaps capture EEG changes in this area with cortical EEG electrodes. Vlad Vyazovskiy, working on his Ph.D. in my laboratory, learnt in Lausanne to carefully cut whiskers of mice. He proceeded to cut whiskers on only one side of rats or mice in the early morning (see top left), placed the animals in an enriched environment where they used the remaining whiskers for several hours by investigating the new toys (top right). One group of rats was sacrificed to determine 2-deoxyglucose (DG2) uptake as a marker of neuronal activation of the region (bottom right shows the higher DG2 uptake in the stimulated area) and another group, with EEG electrodes implanted on the cortex over both barrel fields was allowed to sleep. At the bottom left the EEG power differences between the left and right electrodes, which as predicted were significantly higher over the stimulated cortex compared to the ipsilateral, unstimulated cortex (\*  $p < 0.05$ ,  $n = 12$  rats) are illustrated. These experiments were the first demonstration of a use-dependent effect on EEG activity over a predicted area in an animal model (Vyazovskiy *et al.*, *J. Sleep Res.*, 2000; *Eur. J. Neurosci.*, 2004), later confirmed in a rat “handedness” model (Vyazovskiy *et al.*, *J. Neurophysiol.*, 2008). First demonstration of a use-dependent effect on sleep EEG activity over a predicted area in an animal model. Unilateral whisker stimulation in mice and rats, which were subsequently allowed to play in an enriched environment, led to higher deoxyglucose uptake as well as to higher amount of EEG slow waves (0.75 – 6 Hz band) in the “stimulated” hemisphere. (Irene Tobler)



**Figure 9.** Adenosine and nitric oxide concentrations increase in the basal forebrain of rats during three hour sleep deprivation and decline rapidly during recovery sleep. The figure summarizes a research project of almost ten years. It started at Harvard Medical School in Dr. Robert W. MacCarley’s laboratory year 1996. In collaboration with Dr. Robert Strecker we improved the HPLC-based adenosine assay to be able to measure adenosine from *in vivo* microdialysate samples. Within a year we completed a series of experiments where cats were sleep deprived and adenosine was measured from different brain areas. As we had predicted, adenosine levels increased during the deprivation and declined in recovery sleep. Surprisingly, this effect was found only in the basal forebrain and to a lesser extent in the cortex. To find out why, I continued *in vivo* microdialysis studies with rats after my return to Helsinki, now assisted by Dr. Anna Kalinchuk. Within two years she managed to identify another molecule in the basal forebrain, nitric oxide (NO) that behaved similarly as adenosine in sleep deprivation. Also this finding provided us with a surprise: the increase in NO was induced by inducible nitric oxide synthase (iNOS), which is expressed as response to immunological challenge. Our interpretation of these data is that sleep deprivation disturbs brain energy balance, particularly in the basal forebrain, and alarms the defense mechanisms. A. Adenosine concentration. B. Nitrite and nitrate ( $\text{NO}_2^- + \text{NO}_3^-$ ) as indicator of NO. Black bar: baseline, grey bar: sleep deprivation, white bar: recovery sleep. Samples were collected using *in vivo* microdialysis and measured using high performance liquid chromatography with UV detection. The work was performed by Dr. Anna Kalinchuk and Tarja Porkka-Heiskanen. (Tarja Stenberg)

# Historical Review of the ESRS

More recently, serotonergic status within the embryonic or neonatal brain has been shown by Joëlle Adrien and colleagues, to have long term effects on sleep patterns in mice, especially for REM sleep, as illustrated in Fig. 10. Although the potential wider long term behavioural implications for these animals remains to be fully established, these findings do point to possible concerns for drug treatments in pregnant women with mood disorders.



**Figure 10.** Long term effects of serotonin impairment during infancy. Sleep patterns at adult age depend on the serotonergic status during early development. This was shown in mice using treatment with a serotonin reuptake inhibitor (SRI) during 15 days after birth or during 21 days *in utero*. Such exposure to SRI induces life-long alterations of sleep patterns, i.e., an enhancement of Rapid Eye Movement sleep, eventually associated with increased anxiety. This effect is accounted for, at least in part, by the serotonin impact at 5-HT<sub>1A</sub> receptors since the association of a 5-HT<sub>1A</sub> receptor blocker to the SRI prevents the deleterious action of the SRI alone on sleep patterns. These results might contribute to assessing the risks-benefits balance of treatments in depressed pregnant women and to find novel management of antenatal mood disorders (Popa et al. *J Neurosci* 2008, 28: 3546-3554). (Joëlle Adrien)

## Sleep Medicine

Sleep Medicine is a young and developing field that hardly existed when the ESRS was founded. In 1970s, Elio Lugaresi and Fabio Cirignotta (Fig. 11 centre picture) and colleagues began working on strange and unrecognized types of epileptic seizure linked to a sudden awakening from slow wave sleep. These were eventually identified as paroxysmal, sudden awakenings usually lasting less than 15 seconds and accompanied by dystonia and/or dyskinetic movements of part of the body. A more complex form was named as ‘nocturnal paroxysmal dystonia’, characterised by more dramatic rhythmic movements (e.g. hand clapping) and complex, often emotional behaviours (e.g. whistling, swearing). These epilepsies are now known to centre on prefrontal corticolimbic areas and systems.

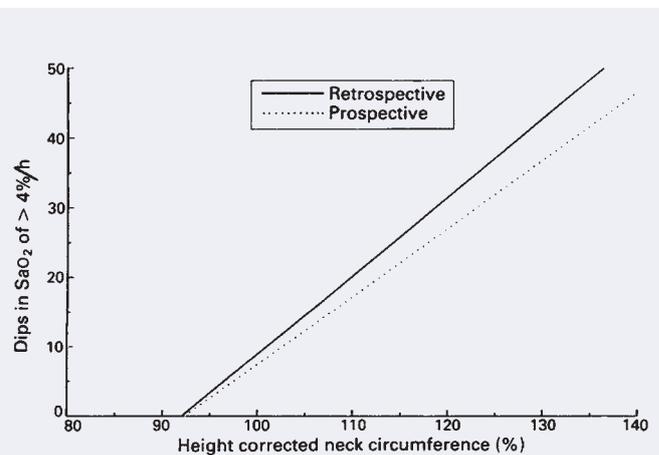
Whereas ‘heavy snoring’ was largely dismissed as a credible sleep disorder even thirty years ago, obstructive sleep apnoea (OSA) is now by far the most common sleep disorder causing excessive daytime sleepiness, and is largely associated with obesity. More to the point, John Stradling’s group in Oxford, UK, clearly established that a fat neck was the more likely culprit, here, as can be seen in Fig. 12.

Who knows what the next 40 years will hold for sleep research, and how many of our younger researchers will then look back and marvel at the findings of today’s pioneers?



**Figure 11.** Cirignotta and I started working on the topic in the early 1970s: we are at the centre of the photo with our backs to the equipment that allowed us to identify this strange new type of epileptic seizures. On the left in the photo are Prof. P. Montagna (who died prematurely last year) responsible for the ward our patients were admitted to, and Prof. P. Tinuper an epilepsy expert in charge of the electroencephalography laboratory. Both colleagues worked closely with me and Cirignotta from the outset making a major contribution to our work. On the right of the photo are Dr. F. Provini and Dr. G. Plazzi who joined the sleep research laboratory a few years later.

Research into the semiological aspects of nocturnal seizures linked to synchronized sleep (spindles and delta sleep) and the identification of their peculiar clinical and electrophysiological features was made possible by concomitant polygraphic and audiovisual recording. This technique allowed us to distinguish two types of epileptic seizures linked to slow sleep: *paroxysmal arousals*, seizures lasting less than 10 – 15” in which a sudden awakening is associated with dystonic posturing and/or dyskinetic movements of a body segment; *nocturnal paroxysmal dystonia* in which the seizures become more complex and with dystonic posturing accompanied by choreo-ballic and rhythmic movements of the arms (e.g. rhythmic hand clapping) and legs, (and rocking coitus-like movements of the trunk and pelvis). These disorders were flanked by complex behaviour like whistling, swearing, pleading, shouting threats or crying for mercy. We also documented that irrespective of their duration these seizures are accompanied by a major autonomic component affecting the cardiocirculatory and respiratory systems. (Elio Lugaresi)



**Figure 12.** Neck size as a predictor of OSA. Over twenty years ago, our group at Oxford had suspected that neck circumference might be a more useful indicator of OSA than was the commonly used body mass index (BMI) and, in 1992, we were able to demonstrate this. The graph, of linear regressions, from our paper<sup>7</sup>, shows the relation between height corrected neck circumference and number of dips of more than 4% in arterial oxygen saturation (SaO<sub>2</sub>) per hour, for two groups of patients diagnosed with OSA. One group (n=150) was used retrospectively to identify independent predictors of dip rate, where collar size was indeed shown to be a better predictor (r<sup>2</sup>=0.35) than BMI (r<sup>2</sup>=0.28). The second, independent, prospective group (n=85) was then used to test further this collar size predictor, and the other findings were confirmed (r<sup>2</sup>=0.38). The graph shows the very similar outcomes for both groups (John Stradling). ‘Davies RJ, et al 1992, Neck circumference and other clinical features in the diagnosis of the obstructive sleep apnoea syndrome *Thorax* 47:101-105.

## Sleep and Neuroscience

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Neuroscience can be defined as the scientific study of the nervous system in health and disease and most of the research achievements regarding sleep pertain to this vast field. Thus, the task of selecting the major contributions to Sleep and Neuroscience from the past forty years for the ESRS anniversary book is a great challenge. In the present chapter, several topics related to Basic Neuroscience will be addressed, leaving to others the duty of dealing with Clinical Neuroscience. Also, the aspects concerning sleep and cognition will be covered elsewhere in this book. Finally, although plenty of fundamental observations have been made in the past forty years by European and non-European ESRS members who have been active outside Europe, we will concentrate on outcomes from laboratories established within Europe.

According to these premises, three major research approaches will be addressed from among those which have allowed European basic sleep researchers to provide original experimental and theoretical contributions since the founding of ESRS. The first, which may be placed in the field of the “reductionistic” approach to scientific investigation, concerns the study of sleep-related brain areas and brain mechanisms underlying sleep occurrence. The second, which may be addressed as “integrative”, explores the complexity of the brain regulation of physiological functions during sleep at a behavioural level. Last but not least, the “phenomenologic” approach, which has quantitatively and theoretically addressed the question of the regulatory processes underlying sleep occurrence, will be considered.

### Sleep-related brain areas and sleep mechanisms

Although the question of sleep-related brain areas and sleep mechanisms was first clearly addressed regarding humans suffering from Spanish Flu by Von Economo at the beginning of the previous century, the study of sleep mechanisms is grounded in animal research. In the years between the two world wars, Frédéric Bremer’s and Walter Rudolf Hess’s experiments set the basis for two different conceptual approaches to the problem of sleep generation. These considered sleep as either the “passive” result of a decrease in the wake sensory inputs to the brain or a complex behaviour which is “actively” promoted by specific brain areas, respectively.

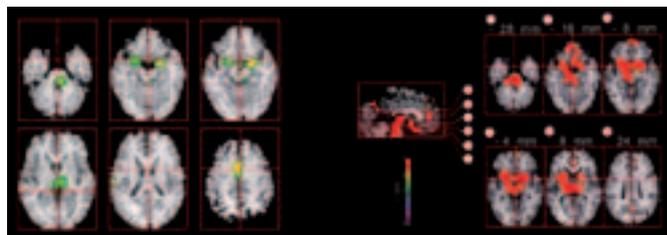
However, the milestone of the modern approach to this research field may be considered the book “Neurophysiology and Neurochemistry of Sleep and Wakefulness” in which, in 1972, Michel Jouvet and Giuseppe Moruzzi extensively and brilliantly reviewed the available knowledge about the neurochemical and neurophysiological brain mechanisms underlying sleep occurrence. Moruzzi’s conclusion that “the wake-sleeping cycle is present in an isolated cerebrum” buried the passive theory of sleep, while Jouvet’s comment that any theory of sleep “could not be explained by classical electrophysiological mechanisms” (a comment which was explicitly based on the concept of “hypnotoxin” introduced by Henri Piéron at the beginning of the century) was a bell announcing a new era in the molecular approach to sleep regulation.

On one hand, Moruzzi’s baton was passed on to several generations of sleep researchers, who have provided a fundamental contribution to the understanding of the mechanisms of the thalamo-cortical dialogue during slow wave sleep, the modulation of cortical excitability and connectivity in the different wake-sleep states, and the generation and spreading of slow waves across the cerebral cortex.

On the other hand, starting from Jouvet’s hypothesis as to the existence of a specific “paradoxical” sleep stage whose executive neurophysiological mechanisms were identified at the rhombencephalic level, research on REM sleep mechanisms eventually led to a highly detailed definition of the network underlying REM sleep generation at the pontine level. Also, the anatomical and functional relationship of this network with the periaqueductal gray and the lateral hypothalamus has been shown. These achievements have been paralleled by a progressive abandonment of the original hypothesis of a monoaminergic/cholinergic control of REM sleep onset, due to a body of evidence supporting a glutamatergic/GABAergic control. The recent development of the optogenetic approach to nervous function, which permits a fine and specific manipulation of the activity of different central nervous areas in freely-moving animals, is expected to lead, in the next few years, to a further clarification of the sleep-related network, possibly in terms of the functional relationship between the brainstem and diencephalic/telencephalic areas.

The study of the brain mechanisms of normal sleep in humans has been precluded for a long time, mainly due to inherent limitations of electrophysiological recordings at the scalp level that did not permit direct recording of deep cerebral activity in healthy sleeping subjects. However, in the past two decades, the development and availability of novel functional brain imaging techniques have renewed the field, allowing sleep researchers to record markers of neural activity during human sleep in a non-invasive manner.

Early positron emission tomography (PET) studies showed a marked reduction in global brain glucose consumption during slow wave sleep but not REM sleep. However, subsequent functional PET studies using oxygen-labelled markers revealed that cerebral blood flow variations could be investigated at the regional level, yielding evidence for dedicated networks of key brain structures which were differentially involved or disengaged during sleep stages (Fig. 1). Still, the PET contribution was somehow limited by poor temporal resolution, about one minute, and therefore mostly showed evidence of sustained, continuous cerebral activity during sleep.



**Figure 1.** Positron emission tomography studies disclosing the functional neuro-anatomical networks subtending REM (left) and non-REM (right) sleep stages in healthy sleeping humans (Maquet et al. *Nature* 1996, *The Journal of Neuroscience* 1997).

Taking a further step, functional magnetic resonance imaging (fMRI) refined temporal resolution to the scale of the second, still far beyond the neural transmission timescale but enough to allow researchers to challenge the neural correlates of transient sleep events, for instance rapid eye movements (and underlying ponto-

geniculo-occipital activity bursts) and sleep spindles. EEG-fMRI recordings also revealed increased, positive regional responses in key brain areas during the depolarizing phase of slow waves and delta activity, further showing that decreases in cerebral activity during slow wave sleep, as measured by PET, actually reflect increased synchronization of thalamic and cortical ensembles. Finally, progress in high-density EEG (hEEG) and magnetoencephalography (MEG) techniques now permits their exquisite temporal resolution to be merged with a markedly improved reconstruction of the neural sources of the signal, which, in combination with the other techniques, opens large avenues for novel investigations. For a few results, MEG further evidenced at the millisecond scale the sequence of brainstem then cortical activity eventually leading to rapid eye movements in man, and MEG-hEEG combination evidences interplay between synchronous and asynchronous activities underlying sleep spindles organization. Furthermore, one definite feature of these neurophysiological techniques is that they allow a thorough investigation of spontaneous and induced oscillation patterns in the brain that can be seen both as the emerging features of underlying regional cerebral patterns (e.g., slow waves and corticocortical information transmission using hEEG), but also as functional activities underlying higher-order cognitive functions during sleep (see other chapters).

## Brain regulation of physiological functions during sleep

The study of the systemic neural regulation of physiological functions during sleep in mammals, which started in the late 1960s, has shown evidence of a striking operative dichotomy between non-REM sleep and REM sleep. Regarding Cannon's principle of physiological homeostasis, it was found that during sleep this principle applies only to systemic physiological regulation in non-REM sleep. REM sleep is characterized by instability or lack of regulation of physiological functions, a functional condition which can be termed "poikilostasis".

The first experimental evidence pointing to a basic functional difference between non-REM sleep and REM sleep was obtained studying thermoregulation during sleep. In addition to thermoregulation, the regulation of circulation and respiration also clearly showed this sleep-dependent physiological dichotomy. On this basis, the functional phenomena characterizing the two sleep states appear to be a result of mechanisms revealing opposite operational paradigms, homeostatic and poikilostatic, of systemic physiological regulation.

The teleological significance of this striking regulatory dichotomy is still unclear. However, non-REM sleep and REM sleep may be considered the result of a sequence of synergistic and antagonistic interactions between the control mechanisms of the homeostasis of the brain and that of the homeostasis of the body, respectively. In non-REM sleep, the homeostasis of telencephalic structures may take place without affecting the control of body homeostasis, since the latter is essentially carried out by structures of the brainstem still under diencephalic regulation. In non-REM sleep, therefore, telencephalic homeostasis and the control of body homeostasis are processes occurring concomitantly in different brain structures. In REM sleep, brain homeostasis may concern diencephalic and brainstem structures. This would explain why, during REM sleep, the control of diencephalic and brainstem homeostasis and that of body homeostasis, which involve the same brain structures, are reciprocally exclusive.

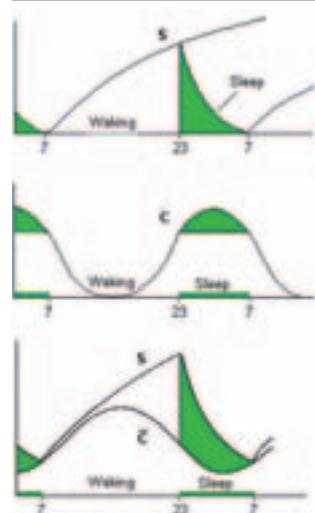
In response to deviations from the range of neutrality, the control of body homeostasis initially prevails over that of neuronal homeostasis, bringing about a cumulative sleep debt to be paid later on. Particularly, REM sleep is depressed as a

result of its inherent antagonism of homeostatic regulation. In addition, according to the intrinsic complexity of the interaction of mechanisms underlying brain and body homeostasis, the occurrence of the ultradian sleep stages is also influenced by the circadian and seasonal changes in environmental variables. In conclusion, a clear-cut operative dichotomy in the regulation of body and brain homeostasis characterizes the ultradian evolution of sleep stages.

Recent data have shown that the release of antidiuretic hormone under the delivery of a central osmotic challenge does not change during REM sleep compared to non-REM sleep and wakefulness. This may suggest that the operational paradigm which defines REM sleep is inherent in thermal and autonomic regulations. However, future studies are expected to clarify whether this apparent state-independency is a specific feature of osmoregulation (a phylogenetically old regulation) or whether it is common to all neuro-endocrine hypothalamic responses.

## Regulatory processes underlying sleep occurrence

A further achievement of the European basic sleep researchers in the past 40 years has been the identification and definition, in quantitative terms, of the role of the homeostatic and circadian physiological processes in regulating sleep occurrence. In a way, the concept of homeostasis was already present in the view of Claparède, professor of psychology in Geneva, who wrote in 1905: "By rendering an animal unresponsive, sleep prevents it from reaching the stage of exhaustion." A precursor of the circadian facet of sleep regulation was Hess's concept of ergotropic and trophotropic systems. During sleep, the trophotropic system, whose functions include restitution and anabolism, predominates. Hess's concept is congruent with the present notion of the circadian system, although he was not yet aware of its endogenous rhythmic aspect.



**Figure 2.** A homeostatic (Process S; top) and a circadian process (Process C; middle) contribute to sleep propensity. They complement each other during sleep. In the two-process model (bottom) the intersection of S with an inverse of C defines sleep termination.

In the two-process model of sleep regulation, a sleep-wake dependent hourglass process interacts with a sleep-wake independent circadian process and thereby determines the timing of sleep. EEG slow-wave activity (i.e. power in the 1.0 – 4.5 Hz band) has proved to be an excellent marker of the homeostatic process both in human and non-human mammals (Fig. 2). The model has served as a useful guiding principle for numerous experiments. In an elaboration of the model by Tononi and Cirelli the salient homeostatic processes are located at the synaptic level.

# Past – Present – Future

Three recent developments are noteworthy: (1) The rising sleep pressure in the course of the waking episodes is evident in the human waking EEG. Thus theta activity has been shown to be a marker of sleep homeostasis whose rise rate is correlated with the initial level of slow-wave activity in subsequent sleep. (2) The EEG marker of sleep intensity has been shown to have a regional facet in humans and animals. Activation of a specific cortical area during waking induces enhanced regional slow waves during sleep. (3) Rest in invertebrates has been shown to have regulatory properties that are similar to sleep in vertebrates. Hence invertebrate models can be used for studying genetic and molecular processes involved in sleep regulation.

## Concluding remarks

The complexity of the relationship between sleep and brain functions is still overwhelming. However, it may be reasonable to hope not only for a progressive development but also for a stronger integration of the three different approaches addressed. The apparent dichotomy between the need for homeostasis of the cerebral cortex during non-REM sleep, which leaves body homeostasis untouched, and, possibly, that for homeostasis of diencephalic and brainstem areas during REM sleep, which deeply interferes with body homeostasis, should be resolved. Clarification is required, in terms of the activity of the neuronal network underlying brain activity and the brain-body relationship during sleep, and in terms of a unitary model of non-REM and REM sleep regulation satisfactorily fitting data from human and animal studies. Will this keep us busy for the next forty years?

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## Sleep and Neurology

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### The origins (1600 – 1950's)

The neurology of sleep started in Europe with the clinical descriptions of Restless legs syndrome (Willis 1672, Wittmaak 1861), sleep paralysis (van Diemerbroeck, 1664, depicted by the painter Füssli in 1781 (Figure 1), disturbed sleep breathing and snoring after stroke (Cheyne 1818, Broadbent 1877), hypnagogic and hypnopompic hallucinations (Baillarger 1846, Maury 1848, Meyer 1903), narcolepsy (Westphal 1877, Gélinau 1880), severe hypersomnias in the context of infections and focal lesions of the brain (Mauthner 1890, Freund 1913, Trömner 1924-9), periodic hypersomnias (Kleine 1925, Levin 1929), organic insomnia (Morvan, 1890), violent/homicidal sleepwalking (Yellowlees 1878), sleep drunkenness (Gudden 1905), and dream changes/hallucinations following brain damage (Charcot 1883, Lhermitte 1922, Grunstein 1924). Modern neurological sleep research was started by the reports of hypersomnia and insomnia with hypothalamic lesions in the context of influenza epidemics (von Economo, 1916 – 1922), the introduction of the EEG by Berger in the late 1920es, and the works on the neurophysiology of sleep-wake functions made by Hess, Bremer, Moruzzi and Jouvet.



Figure 1. Representation of sleep paralysis and hallucinations ("nightmare") by the Swiss-British painter Heinz Johann Füssli in his famous painting "Nachtmahr"

### The major achievements (1950's – today)

Idiopathic hypersomnia, narcolepsy, hypocretin deficiency

The clinical description and neurophysiological characterization of idiopathic hypersomnia were made by Bedrich Roth in a series of papers over 30 years (1950's – 1980's).

Following the first description of sleep onset REM episodes by Vogel (1960), European researchers (Lammers' and Bassetti's groups) were the first, in collaboration with Mignot's group at Stanford, to report an hypocretin/orexin deficiency in human narcolepsy and other neurological conditions. Contributions from European researchers have been crucial also in expanding the knowledge in the fields of epidemiology (Hublin), genetics (Tafti), neuropathology (Peyron), metabolic functions (Pollmächer, Lammers) and treatment of narcolepsy in both adults and children.

### Sleepwalking and REM sleep behavior disorder (RBD)

The demonstration of sleepwalking as a slow wave parasomnia (Gastaut and Broughton 1965, a dissociated arousal disorder (as assessed by neuroimaging, Bassetti 2000 (Figure 2), and a disease with strong genetic determinants (Lecendreux 2003) were made in Europe.

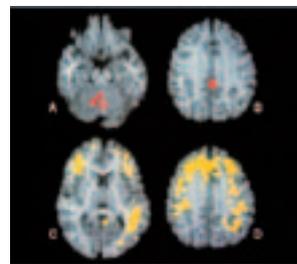


Figure 2. The highest increases of regional cerebral blood flow (in red) during sleepwalking compared with quiet stage 3 to 4 NREM sleep are found in the anterior cerebellum/vermis (A), and in the posterior cingulate cortex (B). In relation to data from normal volunteers during wakefulness (n = 24), large areas of frontal and parietal association cortices (C, D in yellow) remain deactivated during sleepwalking. (With permission from Bassetti et al., *Lancet* 2000.)

The recognition that RBD is a predictor of subsequent development of neurodegenerative diseases is one of the clinically most relevant discovery in sleep medicine in the last decades. Although the first description of this parasomnia and of its role were made by Schenck et al. in the US, several neurological teams in Europe (including those of Iranzo and Santamaria in Barcelona, Arnulf in Paris, Högl in Innsbruck, Ferini-Strambi in Milano and Plazzi in Bologna) made significant contributions to the current knowledge of clinical presentation and associations (with synucleinopathies such as dementia with Lewy bodies and multiple system atrophy), PSG, videographic and neuroimaging characterization, and impact of new biomarkers such as dopamine transporter imaging in the assessment of RBD and the underlying neurodegenerative process (Figure 3).

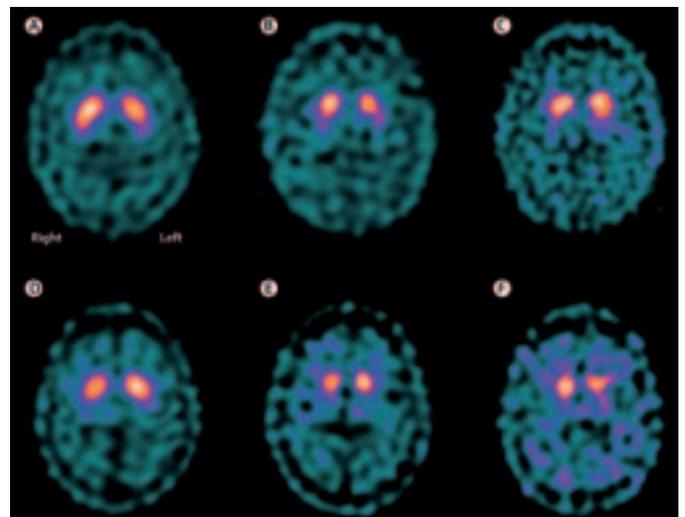


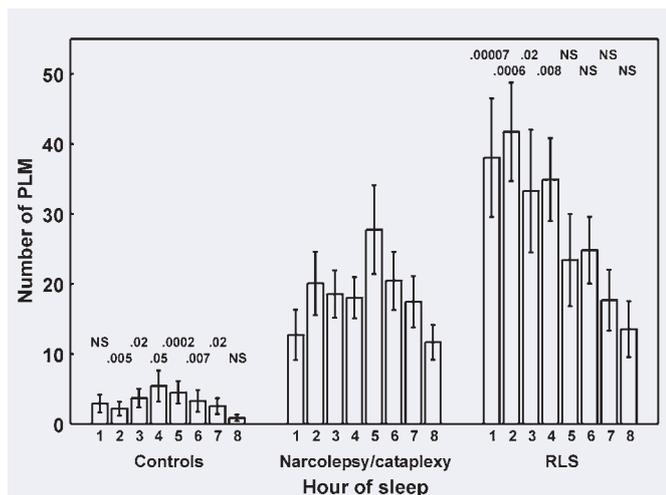
Figure 3. Serial DAT-SPECT scans in patients with REM behavior disorders (with permission from Iranzo et al, *Lancet Neurol* 2011)

## Fatal familial (thalamic) insomnia (FFI)

This new form of prionopathy with selective thalamic damage was described in Bologna emphasizing the role of this brain region in sleep-wake regulation (Lugaresi 1986), as demonstrated by cases of insomnia and hypersomnia observed after thalamic stroke (Castaing 1967, Bassetti 1992). For the association of a severe insomnia with severe distortion of NREM sleep, REM sleep without atonia, and motor restlessness the term of *agrypnia excitata* was coined, a syndrome that has since been observed in the course of paraneoplastic brain disorders (Morvan's disease), other prionopathies, and delirium tremens.

## Restless legs syndrome (RLS) and periodic leg movements of sleep (PLMS)

Following the seminal papers of Ekblom on clinical features of RLS (1944 – 1960) European researchers were fundamental in reporting the association with “nocturnal myoclonus”/PLMS (Symonds 1953, Coccagna and Lugaresi 1965) (Figure 4), the frequency of RLS in pregnancy and neurological disorders, the treatment response to levodopa (Akpınar 1982) and dopamine agonists (Trenkwalder, Ferini-Strambi, Oertel, Kohnen), and genetic markers of the disease (Winkelmann 2007).



**Figure 4.** Distribution of PLMS per hour of sleep in controls, patients with narcolepsy/cataplexy and RLS (with permission from Ferri *et al.*, Sleep 2006)

## Sleep disordered breathing (SDB) and stroke

Following the world-wide first polysomnographic characterization of sleep apnea by the neurologists Kuhlo and Jung (1965) in Germany and Gastaut and Tassinari (1965) in France, the importance of sleep disordered breathing as a risk factor for stroke and a condition influencing its short- and long-term evolution was first demonstrated by European neurologists (Koskenvuo 1985, Bassetti 1996-2012, Iranzo and Santamaria 2002, Parra 2000 – 2011).

## Nocturnal frontal lobe epilepsy (NFLE)

Several European and Extra-european teams have established our today's understanding of the clinical, neurophysiological and genetic characteristics and determinants of NFLE and other nocturnal “hypermotor seizures”. The contribution of the Bologna and Milano neurological Sleep Schools was fundamental in this field and continues today with systematic intracranial studies and neurosurgical interventions by the team of Nobili.

## The future

### REM sleep behavior disorder (RBD) and neurodegeneration

Patients with idiopathic RBD are at risk of developing Parkinson's disease and dementia with Lewy bodies, particularly if abnormalities in dopamine transporter imaging, transcranial sonography, olfaction, and color vision are found. The reliable identification of “high risk” patients with idiopathic RBD is of particular clinical interest and may become a specific target for testing neuroprotective agents. Further research is needed also for the treatment of RBD. Clonazepam may decrease the occurrence of sleep-related injury caused by RBD, but may represent a problem in patients with dementia, gait disorders, or concomitant sleep disordered breathing.

### Sleep-disordered breathing (SDB) and sleep fragmentation and the course of dementia, stroke and other neurological disorders

Considering the suggested role of sleep in neuroplasticity and learning processes it is to be expected that sleep may promote recovery from brain damage and conversely, sleep disorders may affect the evolution of neurological disorders.

Sleep disordered breathing (SDB) and dementia have been recently linked. Some researches suggested common underlying neural mechanisms relating hypoxia and mild cognitive impairment. It has been demonstrated that neurocognitive deficits associated with SDB, mainly involving memory, attention, and executive functioning (associated with decreased hippocampal gray matter), partially improve after treatment with CPAP. The hippocampus is one of the main and most consistently reported brain regions among the neural correlates of mild cognitive impairment. Large trials with CPAP treatment in elderly participants with SDB should be performed in order to verify the possible prevention of cognitive decline.

The high prevalence of SDB in stroke and other neurological patients (e.g. those with epileptic, neuromuscular, and neurodegenerative disorders) and the potential beneficial effect of CPAP have been reported. Further research is needed to both clarify the most effective timing and duration of CPAP treatment and to identify the subgroup of patients that may benefit the most from this intervention.

Finally, recent animal studies suggested a detrimental role of sleep deprivation/fragmentation in amyloid accumulation (and pathogenesis of Alzheimer's disease) and acute focal ischemia progression (and stroke recovery).

### Nocturnal frontal lobe epilepsy (NFLE) and parasomnias

NFLE is due to a dysfunction in the thalamocortical circuit involved in the arousal mechanism. Genetic and neurotransmitter studies suggest that the cholinergic system (and possibly also other pathways) may underlie both NFLE and parasomnias and unify their pathogenesis. As a consequence, their differential remains a challenge. Extensive stereo-EEG evaluations during sleep, as well as genetic studies, may improve our knowledge and contribute to the development of new diagnostic algorithms and more effective treatments for these conditions.

### Restless legs syndrome (RLS)

A question that needs to be addressed is whether RLS has components of a developmental disorder as suggested by so-far identified predisposing genes. The exact role of dopaminergic and opioid transmission and iron metabolism in the pathophysiology of RLS remains to be established. Finally, further research is needed to improve the sensitivity and specificity of RLS diagnosis. Long-term natural evolution of RLS, as well efficacy and tolerability of alternative drugs to the current first line treatments for RLS, should be explored.

## Autoimmune disorders and sleep-wake disturbances

Several reports in the last few decades have stressed the existence not only of narcolepsy syndromes but also of insomnia, hypersomnia, RBD, RLS, and epilepsy syndromes, in parts resembling to the encephalitis lethargica described by von Economo, in the context of autoimmune disorders (multiple sclerosis, paraneoplastic syndromes,...). Future studies will establish the frequency, clinical spectrum, pathophysiological and treatment implications of these fascinating new conditions.

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## Psychiatric Sleep Research

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Since the times of Emil Kraepelin, who conceptualized mental disorders as diseases of the brain in the late 19<sup>th</sup> century, European psychiatry has been at the forefront of searching for biological markers. One early milestone in these attempts was the discovery of the EEG by the German psychiatrist Hans Berger in 1929 which also became the starting point for modern sleep research. From the very beginning psychiatrists were particularly interested in the EEG during sleep, not only because sleep disturbances are present in most psychiatric disorders, but also because the opportunity to observe the sleeping brain would potentially help to unravel the pathophysiology of psychiatric disorders.

In 1972, the year when ESRS was founded, David Kupfer in Pittsburgh published one of the most influential papers in psychiatric sleep research which ever appeared: "Interval between onset of sleep and rapid eye movement sleep as an indicator of depression". This *Lancet* paper, which has been cited more than 1200 times, claimed that shortened REM sleep latency, indicative of increased REM pressure, would be a specific biomarker of major depression. Many European groups followed this track since then. A challenge test, the so-called cholinergic REM sleep induction test (CRIT), was developed by the group of Berger which increased the sensitivity of reduced REM latency as a biomarker of depression. This test used the potential of orally applicable cholinergic drugs (e.g. RS86) to provoke REM sleep. In the 1990s the group of Holsboer and Krieg showed that this test induced reduced REM latency even in healthy relatives of depressive patients who later became depressed themselves. However, Berger and colleagues and other European groups showed that REM sleep abnormalities were far less specific for depression than initially assumed. But still today, sleep abnormalities are among the most robust neurobiological findings in depression.

Numerous European groups performed pharmacological sleep studies in animals and in humans showing, concordant with the supposed monoaminergic/cholinergic imbalance model of depression, a very strong REM suppressive effect of most, but not all antidepressants (Adrien, Berger, Jouvet, Jovanović, Steiger, Oswald).

A further area of intensive investigations by European psychiatrists was the effect of sleep deprivation starting in the early 1970s with the work of Pflug and Tölle. Numerous other groups entered this field (e.g. van den Hoofdakker, Matussek, Passouant, Wiegand) elaborating on the peculiarities of this effect with respect to the duration, timing and specificity (NREM vs. REM) of sleep deprivation, the question which patients profit and the striking relapse-inducing effects of even short naps.

The 2-process model of sleep regulation proposed by Daan and Borbély in the 1980s prepared the scene for investigating and conceptualizing interactions between sleep and circadian rhythms also in psychiatric patients. Phase advance of the endogenous clock was presumed as one possible mechanism underlying the antidepressant effect of sleep deprivation and the chronobiology of psychiatric disorders has been another major topic of European sleep research groups (e.g. Benedetti, Berger & Riemann, Wirz-Justice, Souetre, Schulz, van den Hoofdakker, von Zerssen). Among the topics of this research area were changes in circadian rhythms in depression in general and in winter depression in particular, the therapeutic effects of light therapy and therapeutic approaches combining sleep deprivation with phase advance (e.g. Berger).

Most "classical" hypnotics were discovered in Europe, and the pharmacology of sleep was another important topic of European sleep research. Not only were the clinical effects of hypnotics in patients studied in detail by many groups (e.g. Gaillard, Hindmarch, Rüther, Oswald), but also effects on the sleep EEG were evaluated and more sophisticated automated analyses beyond visual sleep scoring were developed (e.g. Borbély, Gaillard, Gottesmann, Dummermuth, Schulz). More recently European groups have also played a major role in developing cognitive behavioural treatment approaches in insomnia and in studies investigating long-term negative consequences of insomnia on mental and physical health (e.g. Espie, Léger, Riemann, Pollmächer).

Although the last 50 years have challenged the specificity of polysomnographic features for individual mental disorders, disturbed sleep remains one of the most important and promising targets of research and treatment approaches in psychiatric disorders.

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## Sleep and Psychology

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From the inception of the ESRS in 1972, with its first conference in Basel in Switzerland, psychologists and psychology as a discipline were an integral part of the society's endeavours. On the one hand, classical "psychological" topics like dreaming, insomnia, neuropsychology and the field of sleep in mental disorders constituted an important line of research within the scope of the ESRS. Within the field of dreaming, especially an Italian research group led by Mario Bertini has to be mentioned. In the early days of the society, the topic of insomnia was dealt with by P. Visser from Amsterdam. Other clinicians and researchers with a background in psychology who contributed to the initial stages of the development of the ESRS among many others, were Hartmut Schulz (Germany), Inge Strauch (Germany/Switzerland), Jim Horne (UK), Torbjörn Åkerstedt (Sweden), Jürgen Zulley (Germany), Alain Besset (France) and Anton Coenen (The Netherlands).

The activities of psychology/psychologists was and is also strongly reflected by symposia and workshops at the ESRS meetings. In 1980 (Amsterdam) for example, a symposium chaired by P. Visser and D. Schneider-Helmert dealt with the topic of sleep and emotional stress. The Zürich meeting saw a symposium on information processing during sleep (chairs: D. Lehmann/M. Bertini). In Munich 1984, M. Billiard chaired a symposium on Chronic Insomnia with distinguished guests from the US, and I. Strauch organized a workshop on the non-pharmacological treatment of sleep disorders. The meeting of 1986 in Szeged hosted another symposium on sleep and information processing (chairs: M. Bosinelli/P. Salzarulo). In 1988 H. Schulz organized a symposium on Narcolepsy and L. Murri chaired a symposium on sleep and dreaming. This exemplary list reflects the importance and activities in the field of psychology for the ESRS.

Researchers trained in the field of psychology did not restrict themselves to "classical" psychological aspects of sleep research. P. Lavie from Haifa for example excelled in the field of sleep and breathing disorders and sleep genetics. Jim Horne, a UK based psychologist, became the first editor in chief of the society's journal, the *Journal of Sleep Research*. Throughout the 40 years of the existence of the society, input from clinicians and researchers from psychology has never wavered. Indeed, at present psychologists as individuals are active in the fields of basic sleep research and in clinical sleep research, especially in the fields of sleep and mental disorders and insomnia. Likewise, the field of sleep and learning has attracted many psychologists who are now also extremely active in neuropsychology and neuroimaging. Testimony to this contemporary activity, is the work of the European Insomnia Network (EIN; established in 2009). Although too numerous to mention by name, the great majority of members of the EIN are psychologists by profession. It is clear then that psychology has always been and remains a major basic discipline for sleep research as well as an important force within clinical sleep medicine. It will be our task for the future to further strengthen its role within the ESRS on the one hand but also, on the other hand, to disseminate sleep-related knowledge within the field of psychology and related areas.

As core activities the following areas are suggested:

**Methodology:** As many academic psychologists usually have a strong background in statistics and in the development of psychometric instruments, their expertise is needed for the development of statistical methods, scales and sleep questionnaires but also for devising adequate designs for sleep research. Many biologists and physicians who are active in the sleep field have no training in these areas and therefore can only profit from integrating psychological knowledge from these areas. The areas of cognition, vigilance and performance in the sleep field also have benefitted largely in the past by the input from psychological researchers in Europe. These topics per se can be considered domains of psychology and it will be an important task for the future to attract the brightest heads in the field to engage actively in the area of sleep research and become members of our multidisciplinary community.

**Sleep and mental disorders and insomnia:** clinical psychologists trained in behavioral techniques have an important obligation in this field – as is known hypnotic medications are afflicted with a variety of serious problems with respect to long-term treatment of insomnia. Cognitive-behavioral treatment of insomnia (CBT-I), a domain of clinical psychology, is known to be very effective and offers sustained benefits. Thus it is up to clinical psychologists to campaign for insomnia therapy towards establishing CBT-I at different levels of the health care systems in Europe. Indeed, this not only applies to therapy of insomnia but also to other sleep disorders where psychological expertise is needed. For example, cognitive-behavioural approaches to the management of obesity and motivational/ adherence therapies for patients with sleep apnea; integration of behavioural and light therapies for circadian rhythm disorders; and novel psychological approaches for the management of parasomnias. Just as input from psychology has proven to be extremely important for the understanding and treatment of insomnia, the growing emphasis upon Behavioural Sleep Medicine more broadly should provide evidence-based methods to improve sleep health across disorders. The challenges associated with fulfilling this vision should not be underestimated. Nevertheless, the emergence of stepped care approaches to service delivery and internet-based delivery of therapies will help to reach more patients. It will also be important for academic psychologists to include the topic of sleep in psychology curricula within their universities at both undergraduate and postgraduate training levels.

The area of sleep and learning (information processing) has generated some of the most highly cited publications in recent years and also is viewed with much attention from outside the sleep field. This field is very attractive for psychologists with a strong interest in cognitive/ clinical neurosciences. A combination with neuropsychology and neuroimaging, therefore, seems very promising and synergistic. This importance is reflected in the fact that psychologists have been able to establish research-oriented sleep laboratories at their universities.

In summary, psychology and psychologists have been involved in the ESRS since its starting days. Several key aspects of expertise in psychology, highly relevant to sleep research and sleep medicine have been identified. In the future a bi-directional approach is suggested as the main strategy. That is, we need to attract more psychologists to join the sleep field; but also the dissemination of sleep-related knowledge into the field of psychology needs to be enhanced. Furthermore, given the interdisciplinary nature of sleep research and sleep medicine both psychology as a scientific discipline and psychologists, either research-oriented or working as clinicians, are an integral part of this effort.



## Sleep and Sleep Disordered Breathing

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### How did it start?

The earliest reports on disturbed breathing during sleep came from Kuhlo in Germany and Gastaut in France. However, the modern history of sleep disordered breathing (SDB) in Europe, started in Bologna, Italy, by Lugaresi and coworkers with their seminal work on snoring and hypertension (Lugaresi *et al.*, 1980). A series of meetings starting with the "Sleep Disorders Conference" in Bologna, gathered researchers from a large part of the world, and it was established that SDB may represent a public concern. However, it was not until the introduction of continuous positive airway pressure (CPAP) therapy in the early 1980s that sleep diagnostic units were established on a larger scale in Europe. Colin Sullivan in Sydney had published on CPAP in 1981 (Sullivan *et al.*, 1981) but no-one, not even in their wildest dreams, could have anticipated how this technology would alter the SDB arena. The number of patients treated not only by CPAP but also with upper airway surgery, grew steadily in many European countries, although, the recognition of SDB was far from being well established. Centers in the forefront of the early development in Europe were those in: Strasbourg headed by Daniel Kurtz and Jean Krieger, Edinburgh by Neil Douglas and Marburg by Jörg Hermann Peter and Thomas Podszus. The volume of research papers in the area grew steadily, and seminal meetings that brought more researchers and clinicians into the field, were the 'Symposium on Sleep and Health Risk', held in Marburg in 1989, and the ESRS meetings in Strasbourg in 1990, and Helsinki in 1992.

### Major achievements

The early publications on SDB prevalence, by Thorarinn Gislason, in Uppsala, suggested that obstructive sleep apnea (OSA) may be prevalent in 1.3 % of the adult population. Similar and higher numbers were subsequently reported from the USA, from many areas of Europe, and from Israel. It became evident that far higher proportions of the population may suffer from the breathing disorder without apparent daytime sleepiness. As a consequence, intense research activities aiming to better understand this prevalent condition were initiated by several European laboratories. The European contributions to research in SDB thereby ended up to include many groups of researchers and clinicians having various interests in medicine, including epidemiology, pathophysiology and comorbidity, especially the consequences, including daytime sleepiness and cardiovascular disease.

Sleepiness, the most obvious effect of SDB, was soon targeted for investigation by the Edinburgh and Oxford groups. Moreover, the prevalence and risk of traffic accidents in relation to SDB was explored by groups in Grenoble, Bordeaux, Burgos, Stockholm, Helsinki and Antwerp. Several of these researchers have also worked intensively on regulatory issues related to SDB and driving within the European arena.

A close association between SDB and cardiovascular (CV) disease had soon been recognized by the sleep community, but less well accepted among cardiologists and hypertension experts. Fortuitously, it might have been this critical attitude (Wright *et al.*, 1997) that further inspired sleep researchers to associate sleep

apnoea with cardiovascular medicine. Subsequent work, with contributions from several European laboratories, finally led to the recognition of SDB as a treatable cause of hypertension, that was first confirmed in the 2003 JNC7 report (Chobanian *et al.*, 2003). Subsequently, this work has widened the claims with other forms of CV disease, metabolic disorders, even early CV-related death.

Experimental work linking SDB with CV disease included the findings of elevated sympathetic activity and reduced endothelial function in patients with SDB, as shown by the Gothenburg group, and the attenuated baroreflex function that was reported by researchers in Palermo and Milan. Further work in animal and human hypoxic models, provided evidence that blood pressure elevation was related to exposure to intermittent hypoxia, as found by the group in Grenoble. Oxidative stress markers identified in SDB, were reversed by CPAP or modified by Vitamin C, as shown by the Giessen group. Extensive work on oxidative stress mechanisms was subsequently performed by Lavie, in Haifa, followed by groups in Dublin and Grenoble, who demonstrated the importance of inflammatory mechanisms for having a potential role in the development of CV disease in OSA. These core labs, as well as many others, have substantially contributed to the understanding of these complex associations. Unfortunately, the limited space of this review makes it impossible to mention all contributors.

The Wright report, mentioned above (Wright *et al.*, 1997), pointed to the lack of prospective randomized controlled studies on SDB, which soon alerted others in the field to undertake these studies, especially those groups in Oxford, Marburg and Edinburgh. Most importantly, these trials demonstrated the effectiveness of CPAP for SDB. Subsequently, in 1997, Marin and coworkers (Marin *et al.*, 2005) published their important observational study on the efficacy of CPAP, which further stimulated development of the field.

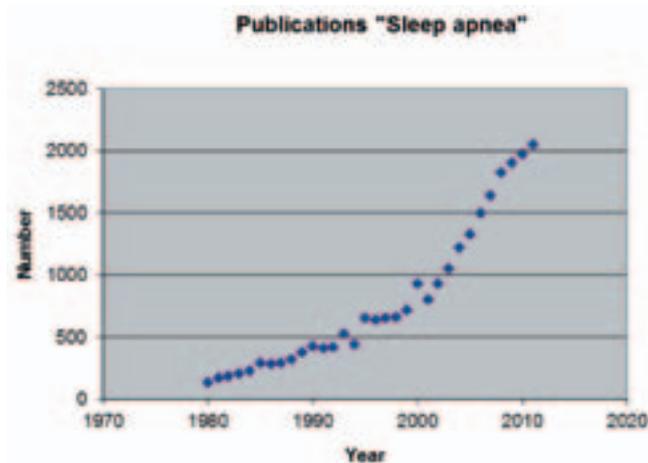
In parallel with these studies there has been an increasing focus on the occurrence of central apneas and Cheyne-Stokes respiration (CSR) associated with cardiac failure. It had been suggested that the prevalence of CSR in cardiac patients was very high, although subsequent investigations have adjusted these numbers somewhat downward. There remains the controversy about the optimal method for positive pressure treatment or even oxygen therapy. Although such intervention often leads to considerable functional and subjective improvement in patients with CSR, it remains to be seen whether treatment leads to improved survival. Considerable contributions in this area have come from the groups in Göttingen, Hagen and Regensburg.

We have now entered the era of large scale research initiatives in SDB. This development has to a large part been driven by genetic research, here. The relevant protocols are underway in several European countries, notably in Iceland, with collaborative projects in Edinburgh. Together with detailed phenotypic classifications, we look forward to further sub-classifications of the SDB condition. Other successful large scale research initiatives include those run by the Spanish network on sleep apnoea research. All these efforts have led to new insights, for instance, into hypertension in symptomatic and asymptomatic forms of SDB as well as the recently reported, but unexpected, association between SDB and cancer from Spain.

Over time there has been an increasing awareness of the close interaction between SDB and metabolic disorders. It was soon recognized that obesity is apparent in up to two thirds of a typical SDB cohort. Moreover, and only by careful statistical analysis, it was established that sleep apnoea is an important risk factor, independent of obesity, for the development of hypertension in

patients with OSA. However, there appears to be links to other forms of vascular disease (e.g. stroke, congestive heart failure) as well as diabetes and metabolic disorders. These associations are undergoing further exploration within the large protocols. Contributions on the organizational front, from the ESRS activities, together with the ever improving structure of the national sleep societies, continues to foster and enable many further scientific and clinical explorations of SDB, throughout Europe.

European sleep medicine has also taken initiatives to develop and apply simplified polygraphy techniques (cardiorespiratory portable recordings) and thereby to offer diagnostic investigations to larger groups of patients. Many centers currently offer considerable ambulatory services for diagnosis and treatment of SDB.



**Figure 1.** Number of yearly publications with the search term “sleep apnea” during 30 years from 1980 – 2010.

## Where do we go?

The history of SDB has certainly been exciting and eventful. However, there is more to come. Highlights we look forward to include results from the first large scale randomized intervention with CSR – the Serve-HF study, with expected recruitment completed in 2012. This may help focus the importance of treatment in a specific form of SDB. Other work demonstrating the cost-effectiveness of CPAP therapy in SDB, will help to further establish large scale treatment programmes for European patients having such a chronic and disabling disorder. Large scale initiatives will rely on the introduction and acceptance of new, simplified diagnostic techniques that address important components of the SDB condition. Clearly, this needs to be based on an improved diagnostic process.

European research into SDB also needs to be cross fertilizing. Researchers must exchange ideas, and all new initiatives are based on interactions between them. One such initiative is the Europeans Sleep Apnea Database (ESADA), currently engaging 27 laboratories across Europe. Over 12,500 patients are already registered in the database, with similar initiatives being generated by the Spanish network.

The history of SDB in Europe has been rather short in many respects, but this new area of medicine is providing a fascinating insight into a previously hidden disorder with a considerable negative consequence on health. In witnessing this evolution during its first 30 years, it has filled us with confidence that we will have some fascinating decades of sleep medicine ahead of us.

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## Sleep and Chronobiology

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### History

Sleep and chronobiology as research disciplines grew up in separate universes. Sleep EEG and single overnight recordings were the preferred tools and approaches in sleep research, while actograms, temperature curves and long-term recording under free-running temporal isolation conditions the gold-standard approaches in chronobiology. One would think that the circadian rest-activity cycle might have struck a chord with those seeking to understand the secrets of sleep, but no, they developed on independent tracks. Perhaps it was the introduction of EEG recordings in a circadian context that really marked the first, somewhat secretive, encounter of the two fields. Jürgen Zulley's description of the changes in the distribution of REM sleep under free-running conditions was a first demonstration of the circadian modulation of sleep structure. Torbjörn Åkerstedt and Matts Gillberg's demonstration of how sleep duration in a simulated shift work context depended not only on the duration of wakefulness, but also on circadian timing, signalled another crucial interaction between the two fields.

The year 1980 was the moment when the courtship appeared in public, leading to the marriage of circadian and homeostatic concepts for sleep regulation. For the first time, a circadian symposium was included at the APSS in Mexico City; for the first time, sleep researchers were invited to a symposium on circadian rhythms in Ringberg, Germany organised by the doyen of the circadian field, Jürgen Aschoff. Here, Charmane Eastman showed how she could simulate much of the free-running and desynchronised human data gathered in the temporally isolated Andechs "bunker" with only one circadian oscillator, and Alex Borbély presented his first diagram of the two-process model incorporating a single circadian oscillator (Process C) that interacted with a homeostatic process of rising sleep pressure (Process S). Their talks inspired Serge Daan to develop the model further (Fig. 1), together with Domien Beersma and Alex Borbély, focussing on spectral analysis of the EEG, in particular slow wave activity (SWA) as a marker for sleep pressure (Daan *et al.*, 1984). Soon after the marriage, the partners tested whether they could live independently from each other. Irene Tobler and Gerard Groos performed the trial separation. It turned out that lesioning the circadian pacemaker did not abolish sleep homeostasis, although it did, of course, mess up the timing of sleep. Next, the model was exported across the Atlantic. In spite of an initial resistance to the two-process model by US researchers, analyses of experiments such as forced desynchrony protocols were based on its predictions and have contributed major insights into sleep regulation. Since that time, chronobiology has been integrated into sleep research worldwide.



**Figure 1.** In the library of the Max-Planck-Institute for Behavioural Physiology in Erling-Andechs, Serge Daan (left) draws his ideas of how the two-process model of sleep regulation could be developed, the morning after Alex Borbély presented his data at the Ringberg symposium, with Gerard Groos as vigilant listener (1980). (Photo: A. Wirz-Justice).

### Major Achievements

#### 1. The 2-process model

The two-process model has inspired an important body of research over the last 25 years, and has elegantly predicted a great deal of phenomena observed in both sleeping and waking, e.g. the negative and positive rebound of SWA after naps and sleep deprivation, respectively, and the build-up of theta activity in the EEG during wakefulness. The forced desynchrony protocol, introduced by Nathaniel Kleitman, used by Rütger Wever in Andechs, and refined by Charles Czeisler, proved to be a major tool in extricating the relative contributions of circadian and homeostatic processes to physiological and psychological phenomena, ranging from the different sleep stages to performance measures and mood (Dijk and Czeisler, 1995). The model has evolved to include use-dependent "local sleep", as initially proposed by James Krueger and Ferenc Obál in our own *Journal of Sleep Research*, leading to the synaptic homeostasis hypothesis of Giulio Tononi and Chiara Cirelli. Particular strengths of the model are its simplicity, close relationship with both sleep and circadian physiology, and strategies to manipulate its constituent processes rather than just a collection of mathematical equations.

#### 2. Multiple clocks and the molecular clockwork

Genetic determinants of sleep and the sleep EEG have long been described, but the discovery of clock genes revealed the ubiquitous presence of circadian clocks in every cell of the body. Studies on clock gene polymorphisms and sleep were stimulated by the finding of a PER2 mutation in familial advanced sleep phase disorder. In addition to using knockout mutant mice to understand the role of a given clock gene in the generation or expression of circadian rhythms, investigation of the sleep EEG revealed surprising changes, first in the studies of Paul Franken and Mehdi Tafti in mice, and later in humans. For example, investigation of individuals with different PER3 isoforms at the University of Surrey showed that clock genes were not just the wheels driving the circadian system, but had wide-reaching effects on sleep, performance, tiredness, mood etc. Furthermore, the demonstration of homeostatic regulation in invertebrate "rest" has opened the way to novel genetic studies of sleep in *Drosophila*.

#### 3. Melanopsin as a circadian photopigment

Relatively recently, the identification of melanopsin-containing, intrinsically-photosensitive retinal ganglion cells by Russell Foster and others, and Debra Skene's group's description of a human action spectrum for melatonin suppression identifying short wavelength blue light as the most effective light wavelength

(Thapan *et al.*, 2001), has had enormous impact on the field. Monochromatic light has proved an elegant tool for dissecting out non-visual photic functions, though the precise interactions of the melanopsin system with rods and cones has yet to be fully elucidated.

#### 4. Light as the primary zeitgeber

The discovery by Al Lewy in 1980 that bright light could suppress melatonin secretion in humans initiated the investigation of light's multitudinous effects on physiology, psychology, and gene expression, as well as its successful therapeutic application in Seasonal Affective Disorder. Light therapy has evolved further (Wirz-Justice *et al.*, 2009), showing efficacy in non-seasonal major depression, depression during pregnancy and in old age, improving sleep disturbances and maintaining cognitive function in Alzheimer's disease. In sleep medicine, light, appropriately timed, is indicated for circadian rhythm sleep disorders, such as advanced and delayed sleep phase. There is enormous potential for the use of light as an entraining agent for a variety of sleep disorders – in particular secondary to other illnesses, whether psychiatric (e.g. in schizophrenia or borderline personality disorder), medical (e.g. in transplant patients, cancer), or just for better entrainment in everyday work or school life ("social jet lag", shift work). In addition, sleep deprivation (wake therapy) and/or sleep phase advance are powerful non-pharmacological treatments for major depression that work within hours, and can be combined with light therapy to maintain response (Wirz-Justice *et al.*, 2009).

#### 5. Melatonin

The pineal hormone, melatonin, rhythmically produced at night, has advanced chronobiology and sleep research, first, by being a reliable marker of circadian phase and second, for its chronobiotic properties (Arendt and Skene, 2005). Josephine Arendt's group has provided a large body of evidence showing that, given exogenously, melatonin is capable of phase shifting the many circadian rhythms driven by the central clock. Appropriately timed, melatonin can thus correct circadian misalignment observed, e.g. in jet lag, shift work, and delayed sleep phase insomnia (Arendt and Skene, 2005). For non-24 h sleep-wake disorder, predominantly suffered by totally blind people, melatonin is the treatment of choice to entrain their free-running circadian rhythms, including the sleep-wake cycle. Melatonin also has transient sleep-inducing properties, likely via its acute distal vasodilatory and core temperature lowering effect.

#### **The Future**

The marriage of sleep and chronobiology has led to integration not just of concepts, but also methodologies, and we expect this to continue in the future. In addition, new non-invasive ambulatory monitoring and biosensor technologies will make it possible for research to take place in real life situations. What is the circadian phase of our shift workers and sleep disorder patients? How much sleep do older people/ mothers/ shift workers really get and when? What can we do to improve what is often a poor relationship between external and internal biological time? The combination of melatonin and light (administered approximately 12 h apart) to phase shift and stabilise circadian rhythms and sleep holds promise for the treatment of a variety of entrainment-related disorders.

The answer to the ancient question "why do we sleep?" may soon be approaching. The marriage of sleep and circadian rhythms and the observed profound influence of light on circadian and sleep physiology, and brain function in general, imply that our

manipulation of light exposure with artificial light may lead us to new fundamental as well as applied knowledge. The recognition of how important sleep and circadian clocks are for health and well-being is growing – e.g. as related to metabolism (and thus to some of the ills of civilisation – obesity, diabetes, metabolic syndrome). Advances in genetics will help us to appreciate the importance of inter-individual differences in sleep and circadian phenotypes. In addition, research into the development of new lighting tools will help minimise sleep and circadian disruption. Europe is well placed to lead this research in chronobiology and sleep.

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## Sleep and Animal Research

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### Past: How did it start?

Three approaches characterized sleep investigations in animals. After the discovery of paradoxical sleep (REM sleep) in cats by Michel Jouvet in the 60ies many groups investigated the occurrence of this state in different mammals, thereby initiating the *comparative approach* to sleep. In the 70ies the group of Yves Ruckebusch of the Toulouse Veterinary School manipulated sleep in large herbivores, and in 1977 Lev Mukhametov published that dolphins exhibit unihemispheric sleep. This remarkable feat was later identified in several other aquatic mammals by Jerry Siegel, Oleg Lyamin and co-workers (reviewed by Lyamin *et al.*, 2008). The *phylogenetic approach* exemplified by Truett Allison's report on the lack of REM sleep in the anteater (echidna), an early mammalian species, in 1972 (later revoked by Jerry Siegel in 1996 by intracerebral recordings) was pursued mainly in birds (Rattenborg and co-workers in Seewiesen) and in some reptiles (notably by William Flanigan in Allan Rechtschaffen's group). Subsequent studies compared species' occurrence of vigilance states and total sleep duration (Zepelin and Rechtschaffen, 1974; Campbell and Tobler, 1984), leading to much speculation on the functions of sleep (e.g. Siegel, 2005). The general consensus is that all animals so far investigated do sleep (Cirelli and Tononi, 2008). The third approach used *animals as models* to understand sleep mechanisms. The first continuous, long-term recordings by telemetry in the rat were published by Alexander Borbély in the late 70ies. He introduced new methods of EEG signal analysis (e.g. spectral analysis) to complement vigilance state scoring. Such methods are now in common use in animals and humans. In 1994 genetically modified mice were introduced to sleep research: sleep and circadian differences were reported in prion protein knockout mice compared to wild-type controls (Tobler *et al.*, 1994). The comparative and phylogenetic approaches resurged by expanding the EEG/EMG definition of sleep to emphasize behaviour by Henry Piéron in 1913 and William Flanigan in 1974 and especially sleep homeostasis (Tobler, 1982), enabling the identification of sleep in invertebrates such as cockroaches, scorpions, and later in bees and *Drosophila*.

### Present: Major achievements

The phylogeny of sleep progressed by defining sleep in many further mammalian species, many of which were recorded by Jerry Siegel and his group and most notably, invertebrates. *Drosophila* became an excellent model organism to dissect the molecular mechanisms of sleep (e.g. Cirelli *et al.*, 2011). Rats and mice used as models to unravel sleep mechanisms have elucidated regional and use-dependent aspects of the sleep EEG, their response to prior waking activity and susceptibility to pharmacological manipulations. Recent studies combined EEG and neuronal multi-unit activity (MUA) activity to show the relation between neuronal up and down states after sleep deprivation and EEG slow waves (Vyazovskiy *et al.*, 2011). The interaction between the two processes, homeostatic and circadian was addressed with an animal model combining rat EEG and MUA recordings in the SCN; a constant routine design separated the contribution of the two processes (Deboer *et al.*, 2008; 2011).

### Future: Where to go?

The rich diversity of animals with an abundance of ecological niches has not been explored sufficiently by sleep researchers (present numbers in Fig. 1). Moreover, existing data sets need to be reconsidered by using modern methods of recordings and analysis. Strict laboratory settings can lead to remarkably different results than recordings in the same species in the field (e.g. sleep duration recorded in sloths in the field using telemetry by Rattenborg *et al.*, 1998). Hibernation and torpor have several similarities with the effects of sleep deprivation (e.g. the increase of EEG slow-wave activity as a function of the previous duration of hibernation or torpor, and its subsequent dissipation during sleep following these states), which still remains unresolved. Our understanding of sleep will profit by investigating effects on sleep of waking activities which demand different efforts. For example animals foraging, i.e. having to work for food rather than the standard ad lib feeding situation or comparison of sleep of lactating mothers having varying amounts of pups will reveal the flexibility of sleep adaptations. Birds are excellent models because they molt, and the amount of eggs in a nest can be manipulated to modify the metabolic effort invested into searching for sufficient food, and lastly, birds migrate, an unsolved challenge to the need for sleep. Phylogeny of sleep will reveal the minimal requirements for a species to exhibit sleep. In model organisms (rats or mice) the functional meaning of high EEG slow-wave activity (or other EEG variables) must be elucidated by including performance tests after sleep disruption or after different spontaneous activities.

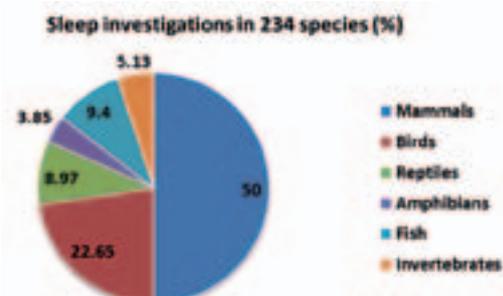


Figure 1.

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## Dream Research

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### 1) How did it start?

Following the discovery of REM sleep by Eugene Aserinsky and Nathaniel Kleitman, published in 1953, studies on dreaming started to be carried out in sleep laboratories. Two of the founding committee members of the ESRS, Walter Baust (Düsseldorf, Germany) and Uros J. Jovanović (Würzburg, Germany) studied the relationship between physiological parameters like heart or respiratory rate and dream content, e.g., whether emotionally intense dreams are correlated with higher autonomic arousal, and presented their findings at the first ESRS conferences. Within this context, Michel Jouvet's (Lyon, France) work with cats that enact their "dreams" during REM sleep (by applying experimental lesions to the brain stem areas responsible for the muscle atonia during REM sleep) should be appreciated. Moreover, while Michel Jouvet contributed to the definition of the distinctive neurophysiological features of REM sleep (which he called paradoxical sleep), he was also fascinated by dreaming and proposed that dreaming corresponds to a rehearsal of instinctual, genetically-programmed behaviours that would preserve the individual's inherited psychological traits. Complementing these early psychophysiological studies, research looking at cognitive and psychological processes in dreams also emerged within the ESRS. Researchers like Marino Bosinelli (Bologna, Italy), Piero Salzarulo (Bologna, and Paris, France), Carlo Cipolli (Bologna, Italy), and Inge Strauch (Zurich, Switzerland) were particularly interested in dream content and memory processes. Beside dream researchers from Europe two distinguished US researchers, David Foulkes and Milton Kramer presented their dream research at the first ERSR conferences. As the number of dream researchers increased over the years (see "Major achievements"), European dream research has evolved into a stronger position within the scientific community. In 2008, Daniel Erlacher and Michael Schredl set up an open access journal (*International Journal of Dream Research*, [www.ijodr.org](http://www.ijodr.org)) hosted by the library of the Heidelberg University to reflect both the growing interest and research activities in this domain in Europe.



Inge Strauch and Allan Hobson at the sleep laboratory opening at the Central Institute of Mental Health, Mannheim, 1987. (Photo: D. Riemann)

### 2) Major achievement

**Basics of dream research.** Research in Europe has addressed a large variety of topics ranging from the definition of dreaming and methodological tools to the psychophysiology of dreaming and clinical aspects such as nightmare treatment. One of the basic questions is whether dreaming, defined as subjective experience during sleep, is always present during sleep. This seems plausible for REM sleep because of the high recall rates from awakenings out of this stage of sleep, while it is less certain for NREM awakenings. Slow wave sleep dreaming has been studied by Corrado Cavallero (Bologna, Italy), who clearly showed that NREM dreaming can be found quite often. Follow-up studies (e.g., Lutz Wittmann, Landau/Germany) showed that brain activation measured by EEG is correlated with dream report length but not dream recall frequency supporting the idea of continuous experiencing during sleep. Dream recall is the prerequisite to the experimental study of dreams and dream research in general, so it is important to identify factors explaining the large inter-individual differences and the intra-individual fluctuations in dream recall. Most of this work has been done by Michael Schredl (Mannheim, Germany) showing that factors like personality (openness to experience), creativity, frequency of nocturnal awakenings, and attitude towards dreams are related to home dream frequency. Nevertheless the major part of the variance remains still unexplained. The most plausible explanation is that dream recall is very sensitive to motivation and attentional factors, i.e., simple encouragements can increase dream recall dramatically. European researchers like Inge Strauch (Zurich, Switzerland), Sophie Schwartz (Geneva, Switzerland), and Michael Schredl (Mannheim, Germany) advanced the method of dream content analysis and applied it to large dream samples. One of the findings was that dreams obtained in the lab or by keeping a dream diary are not as bizarre as is often thought, based on retrospective questionnaires or interviews (outstanding dreams reported long after they had occurred, for example), while dreams do almost never represent true replicates of waking life events. The work of Silvio Scarone (Milan, Italy) also suggested that cognitive bizarreness might be a shared feature of both dreaming and psychotic mentation.

**Psychophysiology of dreaming.** The ground-breaking studies of Pierre Maquet (Liège, Belgium) using positron emission tomography showed that brain activity patterns during REM sleep were different compared with those of slow-wave sleep and to waking state. Areas processing emotional information (amygdala) were more active whereas lateral prefrontal areas (associated with planning, reflecting, etc.) were less activated. Although dream content was not reported in these studies, their findings encouraged other researchers to study the interaction between dreamed activities and brain activation patterns or peripheral physiological parameters. Daniel Erlacher (Bern, Switzerland), for example, showed that knee-bends done in the dream are associated with increased heart and respiratory rates. Lucid dreaming (dreams with more reflective activity because the dreamer knows – while dreaming – that s/he is dreaming) is correlated with an increase in prefrontal activation, as demonstrated in an EEG study by Ursula Voss (Bonn, Germany). Most recently, Martin Dresler and his group (Munich, Germany) monitored two lucid dreamers in the MRI scanner and reported that dreamed hand clenching is related to motor cortex activation – even though the study was a pilot encountering various problems because of fragmented REM sleep due to scanner noise and restricted sleeping position. Yet, these studies clearly indicate that the generation of various dreams with their specific

features relies on the activation of many distinct brain networks. Sophie Schwartz (Geneva, Switzerland) pointed out that specific dream characteristics provide unique and valuable information about cognitive and affective processes occurring during sleep. She showed that some bizarre but common features in normal dreams present striking similarities with neuropsychological symptoms observed in brain-damaged patients when awake, suggesting commonalities in functional brain organization. By providing specific predictions about likely patterns of cerebral activity during sleep, dream studies open up a new road for the interpretation of future brain maps of human sleep while shedding light on the varieties of conscious brain states.

**Continuity of waking and dreaming.** In order to approach the question of dream function several researchers thought it is necessary to study what kind of waking life experiences are reflected in dreams. The so-called continuity hypothesis, which postulates that waking life experiences (actions, thoughts, etc.) are reflected in dreams, has been supported by numerous studies. The group of Dieter Riemann and Mathias Berger (Freiburg, Germany), for example, showed that dreams of depressed patients or dreams of patients with eating disorders clearly reflect the patients' psychopathological symptoms during waking. Studies indicating that sport students dream more often about sports compared to psychology students also support the continuity between waking and dreaming. Similarly, Salzarulo and colleagues (Bologna, and Paris, France) have shown that musicians experience music in their dreams more frequently than non-musicians. Another question pertaining to the continuity hypothesis is whether specific waking-life events are immediately incorporated into dreams (day residue) or after a delay (dream lag effect). Mark Blagrove (Swansea, United Kingdom) demonstrated a dream-lag effect for REM (but not N2 dreams) whereby waking-life elements were represented in dreams not immediately but after a delay of about 5 – 7 days.

**Nightmare treatment.** In addition to studying fundamental aspects of nightmares like threats (Antti Revonsuo, Katja Valli, Turku, Finland) or factors affecting nightmare frequency like gender, stress, neuroticism, sex role orientation (Michael Schredl, Mannheim, Germany), two research groups focused on nightmare treatment. Because nightmares (defined as distressing REM dreams which often awaken the dreamer) severely affects sleep quality, these studies combine dream research with sleep medicine. The group of Reinhard Pietrowsky (Düsseldorf, Germany) developed an 8-session intervention based on the Imagery Rehearsal Therapy and showed that this technique is effective for patients with idiopathic nightmares, with posttraumatic nightmares and even for depressed patient with co-morbid nightmares. In order to help a larger group of patients (i.e. stepped care), Victor Spoormaker and Jaap Lancee (Utrecht, Netherlands) developed a self-help program which was effective – even when presented over the internet.

To summarize, taking together the efforts in studying the interaction between dreaming and physiology, dreaming and waking, lucid dreaming, and nightmare, European dream researchers have been highly influential in the field.

### 3) Where to go?

Since the discovery of REM sleep, the function of dreaming was somehow confused with the function of REM sleep. Yet, whether dreaming fulfils any important physiological or psychological function (be it during REM or NREM sleep) remains an open question. In view of the recent findings regarding memory consolidation during sleep, one wonders whether dreaming is

related to memory consolidation. Although the Italian research group led by Carlo Cipolli and Piero Salzarulo (Bologna, Italy) provided some evidence that memory processes are reflected in dreams, it is yet not clearly established whether dreaming about a given task practiced during the day can enhance performance after a full-night sleep.

Recent technological developments (e.g. combined EEG-MRI technology) provide detailed measures of brain activity of sleeping persons and thus open the possibility to study the interaction between neurophysiological processes and dream content in a more precise and thorough way, which is a promising area for future research. Another interesting option is to study, in patients with sleep disorders, the effect of altered sleep physiology on dream content. Initial studies indicate that patients with insomnia or narcolepsy clearly show different dream recall and dream content compared with healthy controls (Michael Schredl, Mannheim, Germany). Another interesting field concerns enacted dreams in parasomnias, such as in sleepwalkers or in patients with REM-sleep behaviour disorder (Isabelle Arnulf, Paris, France; Sophie Schwartz, Geneva, Switzerland). Or to study dream elements which may depart from waking life experiences such as, for example, walking dreams in paraplegics (Isabelle Arnulf, Paris, France) or the visual content in dreams of blind persons (Teresa Paiva, Lisbon, Portugal).

Another promising area of research is lucid dreaming because this type of dreaming can apparently be used by skilled persons to enhance performance in waking life – comparable with the effects of imagining training practice on sports performance. The research done by Daniel Erlacher (Bern, Switzerland) collecting anecdotal data from athletes, together with pilot studies indicate that lucid dreaming could be an important technique to improve performance.

Although the effect of waking life on dreaming has been widely investigated, studying the effect of dreams on waking life has been relatively neglected. We should thus not only consider the negative effects of nightmares on waking life (impairing concentration, affecting daytime mood, etc.), but also the positive effects like creative impulses or insights. The effective use of dreams in therapy has also been demonstrated but research in this area is still in its infancy.

To summarize, the integration of dream research as part of a broader agenda for the understanding of brain and mental functioning seems a very promising field for the future.

### Acknowledgments

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## Sleep and Genetics

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### How did it start?

The earliest publications documenting that genetic factors contribute to sleep go back almost 80 years [for review see Andretic *et al.* (2008)]. These early studies concern solely the analyses of sleep in twins and, by contrasting the concordance within monozygotic twin pairs to that of dizygotic twin pairs, allowed for the estimation of heritability; i.e., the fraction of total phenotypic variance that can be attributed to additive genetic factors. For sleep heritabilities in the 0.4 – 0.6 range have been reported, indicating that genetic factors account for about half of the phenotypic variance. Later twin studies, quantifying the contribution of various frequency components to the sleep EEG reported heritabilities of 0.9 and higher demonstrating that for EEG traits genetic factors importantly outweigh environmental influences. With these strikingly high heritabilities, EEG traits qualify as the most heritable traits in humans and suggest that they are amenable to genetic dissection.

Despite the numerous reports illustrating the genetic contributions to sleep and the EEG, until recently remarkably little progress has been made in identifying the responsible gene variants. Other than Vogel and colleagues, who identified a locus for a waking EEG trait concerning alpha activity, family-based linkage studies on (non-pathological) EEG traits are lacking. In contrast, in the circadian field, successful examples of linkage studies exist such as for the circadian disorder familial advanced sleep phase syndrome (FASPS) which was found to be associated with alterations in several of the known circadian clock genes. Despite this lack of progress in the genetics of sleep, reverse genetic studies in which the effects of known allelic variants for candidate genes on sleep and the EEG were tested, demonstrate that single genes and in some cases a single nucleotide polymorphism (SNP) can indeed profoundly affect these phenotypes [for review see Landolt (2011)].

Genetic studies of sleep using the mouse as a model species were pioneered by Valatx in the early 1970s. Valatx's group recorded sleep in hundreds of inbred, recombinant inbred (RI), and hybrid mice. He and others documented that many aspects of sleep and the EEG are under strong genetic control confirming the observations made in humans. Only with the development of statistical tools needed to map loci contributing to quantitative traits (quantitative trait loci or QTL) by Lander, Botstein and colleagues, these data could be used to identify genomic region affecting sleep. Almost 20 years after Valatx's group collected sleep data in a panel of RI mice, we used these data to perform the first QTL analysis of sleep. We have adopted the QTL approach in our laboratory and were successful in mapping significant QTLs and their underlying gene variants, for various aspect of sleep (see below).

Besides QTL analyses another unbiased, forward genetic approach utilized in mice is mutagenesis; i.e., the technique of randomly inducing point mutations and screening large cohorts of mice to map and identify those mutated genes affecting a trait of interest. The feasibility of this approach in the mouse was demonstrated first by the isolation of the canonical circadian gene *Clock* by Takahashi and colleagues. While mutagenesis studies for sleep-related phenotypes in mice are under way, mutagenesis screens in the fruit fly *Drosophila melanogaster* by Cirelli and colleagues have already yielded first results, and in some cases, the genes identified could be confirmed in mice. Both approaches have advantages and disadvantages; while mutagenesis will be more successful for

fully penetrant dominant or recessive mutations, the QTL approach is more powerful in detecting natural allelic variations controlling complex traits to which epistasis and modifier genes contribute.

One of the reasons to use a model species in sleep research is, of course, the availability of genetic tools to activate or inactivate genes of interest (reverse genetics) or to study the effects of a human polymorphism or mutation in a model system. Use of these model animals also allows for the study of the molecular consequences of sleep loss in relevant tissues (molecular genetics). Besides mouse and fruit fly, species like the zebra fish *Danio rerio* and the roundworm *C. elegans* are now being used in sleep research.

### Major Achievements

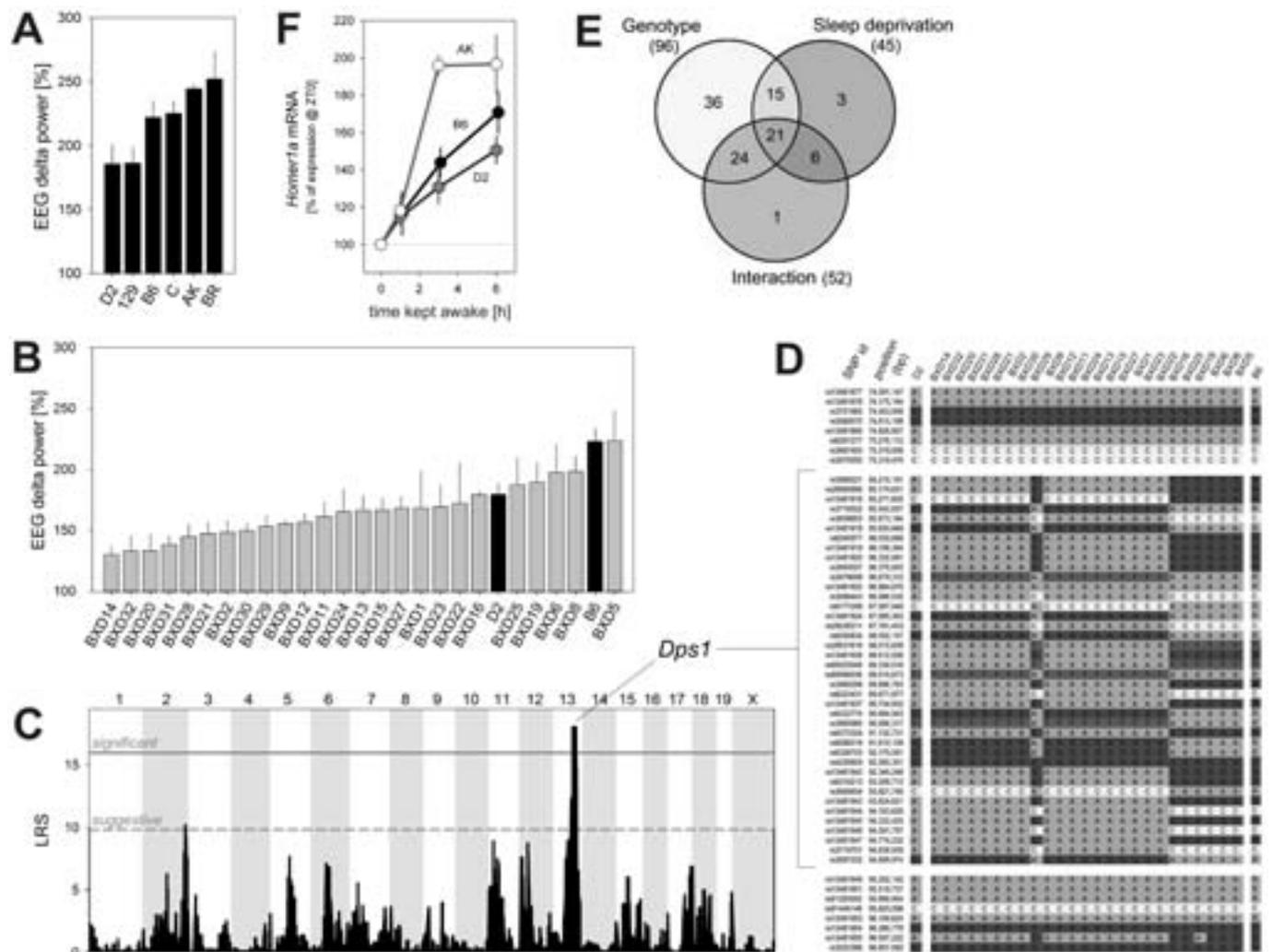
Using QTL analysis we were able to successfully map the genes underlying three EEG traits in mice [reviewed in Andretic *et al.* (2008)]. After an initial assessment of the phenotypic variance in a set of inbred mouse strains we noted large genotype differences in the dominant frequency of EEG theta (6 – 9 Hz) oscillations during REM sleep as well as in the prevalence of EEG delta (1 – 4 Hz) oscillations during non-REM sleep EEG. The segregation of the first EEG trait was followed in an extensive panel of inter- and backcrosses between two strains that differed for theta peak frequency. A single QTL was identified on chromosome 5 and subsequent fine mapping and functional analysis revealed a mutation in *Acads* (*short-chain acyl-coenzyme A dehydrogenase*) responsible for slowing down theta oscillations during sleep. The second trait was mapped in a panel of RI strains of mice derived from two inbred strains differing for EEG delta power. A QTL on chromosome 14 was found and through a combination of forward, molecular, and reverse genetic approaches, *Rarb* (*Retinoic acid receptor beta*) was identified as the underlying gene, thus implicating retinoic acid signaling in modulating cortical synchrony during non-REM sleep.

The third example from our laboratories concerns the homeostatic regulation of sleep (Fig. 1). Comparisons of the sleep-wake dependent dynamics of EEG delta power in a panel of inbred mouse strains, for the first time, demonstrated that the sleep homeostatic process is under genetic control and with it came the promise to identify molecules that modulate the rate at which sleep need increases during wakefulness. QTL analysis in a panel of RI strains yielded a significant locus on chromosome 13. Based on *in silico* and transcriptome analyses, *Homer1a* was identified as a credible candidate gene. These examples demonstrate that QTL analysis can be successful in identifying novel genes and signaling pathways underlying normal sleep and EEG traits.

While reverse genetics approaches are usually applied to test specific and known molecular pathways, sometimes unexpected novel insights can be obtained. Knock-out, transcription, and DNA-binding studies in the mouse suggest that circadian clock genes not only are implicated in circadian rhythm generation but also play a role in sleep homeostasis [reviewed in Franken and Dijk (2009)]. Work of Shaw, Dijk and their colleagues found that the same pathway affected sleep homeostasis in the fruit fly and human, respectively, making this one of the few conserved molecular pathways implicated in sleep homeostasis and suggests that clock genes besides measuring time-of-day, can be used to track time-spent awake.

Although we here focused on the genetics of physiological sleep and EEG traits, in a review on the genetics of sleep the breakthrough findings concerning the sleep disorder narcolepsy should be mentioned [reviewed in Sehgal and Mignot (2011)]. Mignot, Yanagisawa and colleagues using the dog and the mouse as a model, respectively, discovered that the hypocretin (orexin) signaling pathway is implicated in narcolepsy. Subsequent studies

# Past – Present – Future



**Figure 1. Multi-level approach leading to the identification of *Homer1a* as a core molecular correlate of sleep homeostasis.** (A) Comparison of the rebound in EEG delta power after a 6h sleep deprivation revealed that the rate at which this homeostatically regulated variable increases varied among inbred mouse strains (AKR/J=AK; 129 = 129P2/OlaHsd; C57BL/6)=B6; Balb/cBy)=C; DBA/2)=D2; C57BR/cd)=BR). (B) This trait was mapped in a panel of 25 BXD RI strains derived from B6 and D2 and (C) a significant locus on chromosome 13 (*Dps1*) was identified (LRS=likelihood ratio statistic). (D) *In silico* analysis of SNPs in the BXD RI lines and their parentals B6 (right) and D2 (left), identified a distinct haplotype region that narrowed down *Dps1* to an 11Mb QTL harboring *Homer1* at 94.1 Mbp. (E) Whole brain transcriptome profiling of the effects of the factors genotype (inbred strains AK, B6, and D2) and sleep deprivation identified *Homer1a* as the transcript for which the interaction of the two factors was significant the most. Values in Venn-diagrams refer to the number of transcripts significantly affected. (F) Subsequent qPCR analyses confirmed that the dynamics of the wake-dependent increase in *Homer1a* expression in the brain varied according to genotype matching the strain distribution pattern of the rebound in EEG delta power. HOMER1 is a postsynaptic scaffolding protein implicated in learning and memory, axonal path finding, drug addiction, epileptogenesis, complex motor tasks, depression, and chronic pain. The activity induced short splice variant *Homer1a* acts as a dominant negative disrupting the multimeric tethers formed by the long *Homer1b/c* isoforms thereby affecting postsynaptic signaling. Original data published in Franken *et al. J. Neurosci.* 2001; Maret *et al. Proc. Natl. Acad. Sci. U.S.A.* 2007; Mackiewicz *et al. Physiol. Genomics* 2008.

revealed a function for this pathway in behavioural state stability. Nevertheless, polymorphisms in the genes encoding hypocretin or its receptors do not seem to play a role in the aetiology of human narcolepsy. Instead, supported by genome-wide association (GWA) studies in large case-control populations, evidence points to an autoimmune attack targeting hypocretin neurons [see (Hor *et al.*, 2010) and references therein]. Besides for case-control studies, GWA studies can also be applied to identify SNPs associated with quantitative traits such as variations in the various aspects of physiological sleep and the EEG in the normal population. Several of these studies are currently ongoing.

## Where to go?

In the last century the aim and hope was to identify causal linkage between single traits and single gene variants (i.e., a 1-to-1 relation as in Mendelian genetics) or, as for complex traits, linkage between single traits and sets of gene variants (i.e., 1-to-

many). The examples above exemplify that such approaches can be successful. It has, however, become increasingly clear that, in order to gain insight into the mechanisms and pathways, this view can no longer be maintained necessitating the search for causal interactions among sets of traits, networks of genes and their transcripts and products, and networks of developmental/environmental/epigenetic factors (i.e., many-to-many-to-many). This multi-level approach has been referred to as systems genetics. As we are just beginning to appreciate this complexity of genotype-phenotype associations, likewise, systems genetics approaches are just beginning to be implemented. For sleep we made a first attempt towards utilizing such an approach (Fig. 1). As illustrated above, progress in genetics heavily depended and, in all likelihood, will remain depending on the development of computational and statistical tools needed to quantify and interpret results and relationships, on the development of widely assessable genetic reference populations (i.e., genetically stable

mouse lines in which patterns of recombination of two or more parental genomes have been characterized), and, importantly, on genomics technologies enabling us to genotype individuals, sequence genomes and exomes, and profiling changes in mRNA and protein abundance. Progress will also depend on cleverly exploiting the strengths of each of the available model species in parallel, and on the combined use of the various genetic approaches (forward, reverse, and molecular).

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## Sleep Through the Life Span: The First and the Last Steps

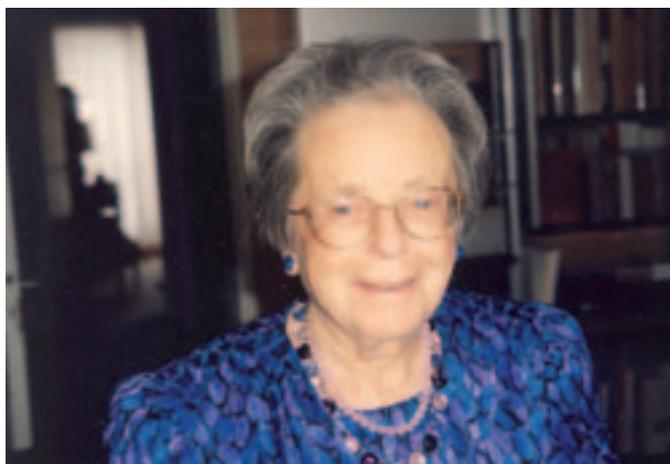
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When we think of the life span we become aware of the important concept of age-related change: Indeed, Feinberg, highlighted age as the most powerful factor that affects sleep pattern changes.

European researchers, as well those from other countries, have been particularly interested in this area, and original studies investigating physiological, pathological and psychological aspects have been conducted in both animals and in humans.

Pioneering work focusing on early development, was completed in the first half of the last century, primarily in Germany, England, Russia and Italy (see Schulz and Salzarulo, 2011 for an extensive review), and France largely contributed in the late 1950s and 1960s with both animal and human research.



**Photo 1.** Colette Dreyfus-Brisac

The crucial experiments with animals were conducted in Lyon by Daniëlle Jouvët, followed by Joëlle Adrien in Paris, both illustrating the early steps of sleep construction, prodromic to paradoxical sleep (called 'seismic sleep'), and interspecies differences (precocious vs. altricial).

In humans, Colette Dreyfus-Brisac in Paris and Heinz Prechtl in Groningen (see pictures) described sleep patterns before and after birth, emphasizing respectively the maturation of the EEG, the neurovegetative system and the concept of 'state'. Their work remains a primary reference for sleep studies in the earliest stages of life.

These studies were further advanced by pupils of Dreyfus-Brisac (Nicole Monod and then Lilia Curzi-Dascalova) with important clinical implications, in particular for brain damaged infants and near miss infants. This last topic has been further developed in the 1980s by André Kahn in Brussels, by Marie-Jo Challamel in Lyon and by Yvonne Navelet in Paris, while in Amiens, Bach and colleagues studied the maturation of temperature control. In Germany Hellbrügge conducted physiological investigations in infants. In Israel A. Scher and A. Sadeh studied psychological aspects.

Study of the development of sleep states through the first year of life and its relationship to nutrition has been, among other things, a major interest of Salzarulo and his colleagues. More recently some labs in Germany and the Netherlands have begun to approach the relation between sleep and cognition in children.

The importance of this focus on development led to the creation of the 'European pediatric sleep club' instigated by André Kahn, with meetings attended by researchers from several countries (Belgium, France, Italy, Germany, Israel, England, Switzerland, Czech Republic, Sweden, as well as USA!).

At the beginning of this millennium, several research groups focused on the awakening process. This has been a crucial time both for exploring underlying physiological mechanisms and for the clinical domains, mainly respiratory and psychiatric. Meetings were organized in many countries to debate methodologies of recording, criteria to define concepts and scoring systems, the role of environmental influences, in particular parental behaviour, and various pathologies, notably respiratory (for an extensive review see Salzarulo and Ficca, 2002).

It should be acknowledged that those developments were given prominence in ESRS symposia (Tirgu Mures 1978, Munich 1984, Jerusalem 1988, Florence 1994, Glasgow 2008, Lisbon 2010) and lectures (Corner, Amsterdam 1980; Prechtl, Florence 1994), as well as in oral and written communications.

Late life sleep was a topic which received attention at first in the clinical context. Some studies had been performed in the early 1960s in Paris (Lairy) and Montpellier (Passouant), showing the main modifications of EEG activity in advanced age and in dementia. René Spiegel in Basel further developed this subject in the 1970s.

Less research conducted in Europe during the following years; however, there has been a renewal of interest in the last few decades in several countries. Some research groups (Florence; Guilford) have been interested in EEG changes (like slow waves activity) and more generally in the 'deconstruction' process of sleep architecture in normal elderly subjects and its relation to circadian rhythms. (behavioural and physiological). Interesting approaches have been initiated recently in France and Belgium (Rauchs), Germany (Hornung), Netherlands (van Someren), Italy (Salzarulo, Ficca), exploring the relation between physiological parameters, behaviour and cognition. In the clinical domain, Alzheimer and Parkinson diseases, in particular are being investigated by groups working in Amsterdam (van Someren), Paris (Arnulf), and Florence (Salzarulo and Giganti). Aging, mainly its pathological aspects, was also a topic of some symposia in the recent ESRS congresses. Future research should study the normal population, which is indispensable to understanding observations made in the pathological domain. It is also important to establish stronger connections between groups working on early development and late life in order to understand similarities and differences between the processes of construction and deconstruction of sleep. Joint symposia at ESRS congresses and collaborative research projects would be a good way forward.



**Photo 2.** Heinz Prechtl (right) and Piero Salzarulo

Waking-sleeping and sleep-waking transitions are of great importance. Further investigations here would be helpful for both basic and clinical research. Future research should also ascertain the contribution of the chronic dysfunction of CNS activity during sleep to the progressive decrease of cognitive resources with aging, that we see in pathological conditions. Finally, sleep and rhythms in the environmental context of nursing homes for the elderly merit both psychophysiological and sociomedical study.

### *Acknowledgments*

I am grateful to Martine Lévy who kindly provided the photo of her mother Dr C. Dreyfus-Brisac.

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## Childhood Sleep Medicine

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### How did it start

The pediatric sleep medicine inside the European Sleep Research Society (ESRS) paralleled the development of the society and since the beginning took active part in the growth of the sleep field in Europe. A very small group of pediatricians, child neurologists, psychiatrists and psychologists interested in sleep during development began to join in informal meetings during the early European Sleep Research Society (ESRS) congresses. The first studies were mainly led by the French researchers following the pioneering work of C. Dreyfus-Brisac (Rouen) and N. Monod (Paris). Various pediatric basic sleep scientists like L. Curzi-Dascalova (Paris), M. Mirmiran (Amsterdam) and K. Paul and J. Dittrichova (Prague), Piero Salzarulo and Iginio Fagioli (Florence), André Kahn (Bruxelles) worked together to start the European research of infant sleep.

Several other enthusiastic persons joined this initial group and began to investigate on this new field of research. I mention here just a few of them: Yvonne Navelet (Paris), Marie Jo Challamel (Lyon), Christian Guilleminault (Paris/Stanford), Marie Françoise Vecchierini (Paris), Claude Gaultier (Paris), Gregory Stores (Oxford), Rosa Peraita-Adrados (Madrid), Sona Nevsimalova (Prague); Miriam Katz Salomon (Stockholm), Christian Poets (Tuebingen) but many other scientists also contributed. All together these scientists made the history of the pediatric sleep science in the last decades.

After the preliminary informal meetings, this group of scientists subsequently constituted the European Pediatric Sleep Club (EPSC), as part of the ESRS, aimed at consolidating the area of pediatric sleep, to bring together clinicians and researchers from different continents and from different disciplines. The EPSC had his own meeting every year since the first one in 1991 in Paris and joins the ESRS Congress every two years.

The EPSC meetings were held in Paris (1991), Helsinki (1992), Prague (1993), Firenze (1994), Messina (1995), Brussels (1996), Lyon (1997), Madrid (1998), Dresden (1999), Istanbul (2000), Bled (2001), Reykjavik (2002), Rome (2003), Prague (2004). Following the efforts of André Kahn from the EPSC, the International Pediatric Sleep Association (IPSA) has been created in 2005.



Figure 1. Soccer match, 12<sup>th</sup> ESRS Congress, Florence, Italy, 1994.



Figure 2. Soccer match, 13<sup>th</sup> ESRS Congress, Brussels, Belgium, 1996.

There are several specific areas of pediatric sleep medicine that received strong input from European researchers in the last 40 years.

At the beginning there were different, active groups in Europe publishing on the early development of the sleep-cycle, sleep EEG and sleep behaviour in infants. The main contributors in this area were Monod, Dreyfus-Brisac, Prechtel, etc. and research into neonatal sleep has developed tremendously. The studies by the Italian group of Salzarulo and Fagioli shed light on sleep organization and sleep states during development. The French group (Curzi Dascalova, Challamel, Monod) worked on the definition of the features of sleep EEG in newborns and respiratory and cardiovascular parameters in newborns and infancy; also the French research contributed to the characterization of sleep apnea, parasomnias and narcolepsy (together with Nevsimalova from Prague). From Belgium, Prof. André Kahn and his group made important advancements in clarifying the mechanisms of the sudden infant death syndrome and of infant sleep apnea. The German group made a big effort to characterize the features of sleep EEG during development, as well as the characterization of infant sleep apnea.

### Major achievements

In an attempt to quantify the growth of pediatric sleep medicine from the constitution of the ESRS, we observed an exponential growth of pediatric sleep papers from 1972. Searching Medline for sleep and all children (0-18 years) we found: 2,292 papers from 1972 to 1980; 3,373 papers from 1981 to 1990; 5,771 papers from 1991 to 2000, and 10,512 papers from 2001 to 2010.

The huge growth in rate of publications reflects the enormous progress of knowledge in the pediatric sleep medicine field in the last 40 years, that it is not easy to synthesize (Bruni, 2010).

### Sleep duration

Children in modern societies are not getting enough sleep and their total sleep time has been declining.

The notion that children are sleeping less than they used to is widespread both in the scientific literature and the popular media. A recent study identified a secular decline of 0.75 min per year in children's sleep duration over the last 100 years and the greatest rate of decline in sleep occurred for older children, boys and on schooldays. This secular decline, variously ascribed to electrification, increased use of technology, and modern lifestyle, is believed to have resulted in many children not getting enough

sleep and being chronically sleep deprived. Although there is a lack of consensus regarding what constitutes “adequate” sleep and whether children are in need of more sleep, the results of this study suggest that short sleep duration is associated with multiple social, physical and mental health deficits such as impaired cognitive abilities and motor skills, mood disorders, obesity, accidents, and poorer overall health (Matricciani *et al.*, 2011).

## Insomnia

Insomnia in childhood is a highly prevalent disorder but no sleep medications are approved by the Food and Drug Administration for the pediatric age. Several reports showed that the prescription of hypnotic/sedative medications is a common practice of general pediatricians and child psychiatrists and that melatonin is becoming a widely used approach for treating insomnia, mainly to decrease sleep latency.

## Sleep Disordered Breathing

In the last years several papers and original investigations highlighted the importance of childhood obstructive sleep apnea as a multisystemic disorder that independently increases the risk for neurocognitive deficits, reduced academic performance, and cardiovascular and metabolic morbidities. The development of neuropsychological deficits and cardiovascular morbidity is not present in all children with OSA and it has been demonstrated that endothelial dysfunction was highly predictive of neurocognitive status. Further, the role of genetic markers in predicting OSA vulnerability has been elucidated.

The impact of OSA on metabolism and the cardiovascular function has also been demonstrated: OSA severity correlated with both lower adiponectin and increased urinary catecholamines, with inflammation markers (i.e. C-reactive protein) and with alterations in autonomic cardiovascular parameters (Gozal *et al.*, 2010).

Finally, the strict correlation between obesity and sleep-disordered breathing (SDB) has been elucidated showing that obesity may be an independent risk factor for the metabolic syndrome, mediated by inflammation, and that weight loss is effective in treating obese children with SDB (Van Hoorenbeek *et al.*, 2012).

## Narcolepsy

Recent research on childhood narcolepsy allowed to better characterize the clinical aspects of the childhood narcolepsy phenotype: childhood cataplexy often appears abruptly as emotionally triggered episodes (e.g. watching cartoons, tickling), spontaneous falls to the ground (e.g. while walking, running, eating), generalized hypotonia, with prominent facial involvement, resulting in the so-called ‘cataplectic facies’ characterized by hypotonia, ptosis, and tongue protrusion, or unsteady gait at neurological examination. Additionally, other typical features of childhood narcolepsy, such as precocious puberty and obesity, have been recognized. New data have shown a robust seasonality of disease onset in children and associations with *Streptococcus pyogenes*, and influenza A H1N1-infection and H1N1-vaccination (Plazzi *et al.*, 2011).

## **Where to go**

The trend of childhood sleep research in the last decades has demonstrated that almost all sleep disorders have negative impact on childhood health; not only OSA, insomnia but also other sleep disturbances such as restless legs syndrome and periodic limb movement disorder have negative influences on behavioural, cardiovascular and quality of life aspects.

The pediatric sleep medicine is a growing field of research with

great possibilities of expansion. The new developments will be based on the technological advancement that will allow to arrange improved diagnostic equipment with new tools and methods of analysis. Future studies will also use more comprehensive genome-wide approaches based on microarrays or next-generation sequencing to identify epigenomic profiles associated with specific phenotypes in pediatric sleep disorders. This approach will allow a better understanding of individual risk factors for adverse consequences of sleep disturbance and therefore find the individualized treatment to reduce long-term neurocognitive, cardiovascular and metabolic consequences.

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## Sleep and Memory

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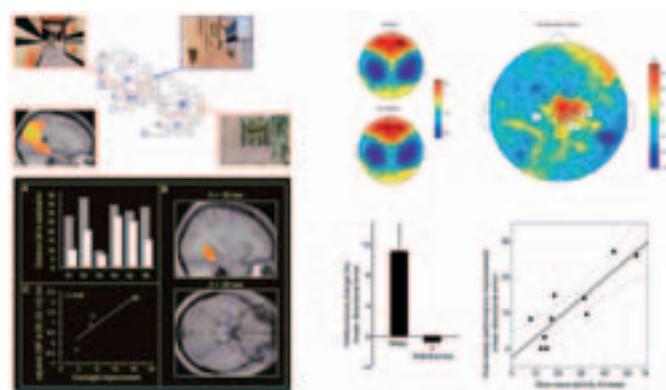
That sleep is implicated in memory processing has been suspected for a long time, but the complete recognition of its positive effect on consolidation of novel learning was obtained in the past 20 years only, to the extent that “sleep is good for memory” now transpires into popular wisdom. In this ESRS 40<sup>th</sup> Anniversary book, we mostly focus on contributions made by European sleep researchers, although it obviously resulted from a worldwide research effort.

Already in 1867, Hervey de Saint Denys reported in his book “Les Rêves et les Moyens de les Diriger” a series of ingenious experiments showing that experienced events are incorporated into our dreams (thus in our sleep), in which they can be combined to create original associations between “memory images” of the past. Sigmund Freud (1900) and Otto Pötzl (1917) likewise observed that even subliminal, non-consciously perceived stimuli at wake could be incorporated in sleep and dreams. At the same time, Ebbinghaus (1885) observed that nonsense syllables learned just before going to bed were more likely to be remembered the following day than when a similar time period of wakefulness occurred in between learning and recall. This result, replicated later on by Heine (1914) then by American scientists, was interpreted as reflecting the passive role of sleep, protecting memories against interference, inhibition, or obliteration by novel information.

However, in the late fifties, the common conception of sleep as a state of cognitive “non-being” in which the resting brain is disconnected was falsified by the discovery of paradoxical sleep by the French neurobiologist Michel Jouvet. Sleep is actually composed of two distinct stages, namely telencephalic (slow wave sleep) and rhombencephalic (paradoxical, also known as Rapid Eye Movement [REM] sleep). Based on behavioural observations and EEG recordings, paradoxical sleep was soon associated with dream mentation and high-order cognitive processes such as ongoing treatment of elaborated external stimuli, revival of experiences and last, but not least, consolidation of new information in memory both in man (e.g. Empson and Clarke, 1970) and animal (e.g. Hennevin and Leconte, 1971). However, the period was also characterized by simultaneous publication of discrepant results in studies apparently using similar experimental designs and tasks in similar species, paradoxically casting doubts on the functional impact of sleep on memory.

Continued research efforts clarified the issue in demonstrating that sleep-related memory processes also involve non-REM (NREM) sleep, which was shown to be an equally active state of the brain but in a different operating mode (see the Sleep and Neuroscience chapter in this book). A further contribution of European sleep researchers was the demonstration that these distinct sleep stages might have distinct memory-related functions (e.g. Plihal and Born, 1997), or even that particular sequences of sleep states reflect the succession of brain processing events supporting memory consolidation (e.g. Giuditta, 1984). In all cases it was firmly established that sleep on the first post-training night is an important step in memory consolidation, still not in an exclusive manner, as memory post-processing also occurs during wakefulness. More recently, European researchers took advantage of novel neuroimaging techniques to demonstrate in

man the persistence during sleep stages of neuronal activities associated with recent learning, and its relationship with overnight performance improvement. Some of these results supported the possibility of a systems-level memory consolidation, during which sequences of newly learned activity patterns are replayed during sleep thereby promoting the integration of new memories into long-term stores. Other results suggested a use-dependent process, akin to sleep homeostasis proposed by Alexander Borbély (1982), by which synaptic efficiency locally enhanced by learning during wakefulness would be homeostatically downscaled during NREM sleep.



**Figure. Systems-level and Use-dependent Memory Consolidation in Man.** Left panel: Learning-dependent reactivation of hippocampal activity during slow wave sleep as measured by  $H_2^{15}O$  PET following declarative spatial learning in a virtual maze, correlated with overnight improvement in performance (adapted from Peigneux *et al.*, 2004, *Neuron*). Right panel: Locally increased slow wave activity over right parietal EEG sensors after practice on a motor adaptation rotation task, correlated with overnight sleep-dependent changes in performance (adapted from Huber *et al.*, 2004, *Nature*).

Pharmacological manipulations revealed the critical influence of neurotransmitter imbalance across sleep stages. Neurophysiological studies have emphasized the role of slow wave activity in the consolidation of recent information in declarative memory, in showing that rhythmic electrical stimulation during NREM sleep in the frequency range of slow oscillations boosts even further memory performance on the next day. Finally, numerous studies consistently reported the involvement of sleep spindles in the consolidation of various memory materials.

In parallel with the continued identification and understanding of the brain mechanisms supporting the action of sleep on memory processes, recent development and exciting perspectives in which European sleep researchers can further contribute are developmental issues and sleep pathologies in relation with memory consolidation. Indeed, studies have evidenced that sleep-dependent learning effects are not systematically found in developing children and normal ageing, which might be partially explained by changes in sleep architecture at least in ageing. On the other hand, sleep alterations are observed in pathologies of ageing (e.g. Alzheimer’s disease) which may contribute to the often-reported associated memory decline. Sleep disorders may also offer us novel windows on memory consolidation processes. For instance, a study recently evidenced the post-training replay of a motor sequence of hand movements during a sleepwalking episode, suggesting reprocessing of this recently learned information during sleep. More generally speaking, pathologies in which normal brain activity is disrupted during sleep, such as interictal epileptic activity, may also participate in an impairment

of memory consolidation and accelerated forgetting over the long term. Altogether, there is still a long way to go before we thoroughly comprehend the way sleep and memory interact and how enduring memories are stored and preserved all along our lifetime.

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## Sleep Medicine: Accreditation and Certification

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The ESRS has fostered clinical sleep science and sleep medicine right from the beginning. Concerns over standards of practice, quality of clinical sleep monitoring and educational resources in the different European countries, have given way to the development of specific task forces within the society.

A **clinical committee**, appointed by the ESRS, met for the first time on May 24, 1994 in Florence, in the presence of delegates of national sleep societies (NSS) from Europe. The only point on the agenda was the subject: 'is there a need for sleep medicine in Europe?'. The basic question was, indeed, whether prevailing opinions would support an evolution towards this new specialty in medicine. Overall, the feeling was that the foundation of this new clinical field would be desirable, but the feasibility was deemed doubtful. In any case, it was considered that the pathway to this goal should lead through the national organisations, and that by no means the decision could be made at the level of the European health authorities. In order to make an inventory of ongoing activities in the various European countries, it was decided to construct a database collecting information on different aspects of sleep medicine. Subsequently, a questionnaire was sent to all known NSS in Europe. The result was a very heterogeneous picture, with disparate figures on sleep medicine practice, financing by health care insurance, and means for education. Therefore, the committee decided to try and establish a set of knowledge items, required for practitioners to qualify in sleep medicine.

A meeting of the clinical committee in Strasbourg on March 31, 1995 resulted in an elaborate remit with detailed recommendations regarding specialty titles, educational aspects, contents of theoretical knowledge and practical training, examination procedures, networking, as well as requirements for professional qualification and for the accreditation of sleep centres. From this broad scope of plans, two major objectives were distilled at a meeting in Brussels on June 19, 1996: recommendations for accreditation of sleep centres and recommendations for educational procedures at different levels. The recommendations for accreditation of sleep centres were published in the ESRS Newsletter of July 1997. The members of the clinical committee went on with their pioneering work until the ESRS decided to reconsider the committee structure of the society and to further corroborate the relationships with the European NSS.

In April 2004, the board of the ESRS had organised a congregation with the NSS in Mallorca. The delegates of the NSS unanimously expressed a desire for a coordinated endeavour to further develop sleep medicine in Europe at an international level. The need for published guidelines on accreditation of sleep medicine centres and on certification of sleep professionals was stressed. As a consequence of this event, a **steering committee** of five individuals was appointed, four of them being president of a NSS at that time. This committee was mandated to materialise the relationship between the ESRS

and the NSS, and to start preparing the requested guidelines. In 2006, the *European guidelines for the accreditation of Sleep Medicine Centres* were published (Pevernagie *et al.*, 2006). In 2008, a change of the bylaws was performed to enable the NSS to become associate members of the ESRS and to include sleep medicine as a key objective of the ESRS. Consequently, the **Assembly of NSS (ANSS)**, representing the different European NSS, was founded as a formal body of the ESRS. The steering committee was renamed the **executive committee** of the ANSS (**EC-ANSS**). The new bylaws also stipulated that one of the members of the EC-ANSS is to be co-opted as a full member of the ESRS board. Under the impetus of the EC-ANSS, two more papers were published: *European guidelines for the certification of professionals in sleep medicine: report of the task force of the ESRS* (Pevernagie *et al.*, 2009), and *Standard procedures for adults in accredited sleep medicine centres in Europe* (Fischer *et al.*, 2011). Each of the three publications was drafted with the consensus of all NSS involved, and with the endorsement of the ESRS board.

Since the ESRS is an organisation that hosts both sleep research and sleep medicine, several activities have been developed in the last few years to foster the development of clinical sleep medicine. The **sleep medicine committee (SMC)** was founded in 2010 to take care of sleep medicine affairs within the society. This committee is directly linked to the ESRS board and interacts closely with the EC-ANSS. The SMC will continue with the work on papers as initiated by the EC-ANSS. The next consensus papers will be a catalogue of knowledge and skills for sleep medicine, an update of the accreditation guidelines, and an outcome evaluation guide for sleep medicine.

The main goals of the SMC are to implement the accreditation of sleep centres and certification of sleep professionals in Europe as specified in the published papers. The certification of sleep professionals in Europe will take place by examinations under the auspices of the SMC. Four certifications are planned. A certification for physicians, for psychologists, for scientists, and for technologists. All will be called somnologist with the addition of the specific type. In 2012 a first round of examinations for sleep specialists is scheduled. For this first round all 'grandfathers' and 'grandmothers' of sleep medicine with at least 10 years practice and strong engagement for sleep medicine in the past are eligible. While it is planned to create European somnologist certification, the accreditation of sleep medicine centers in Europe is not the exclusive responsibility of the ESRS. This process resides inherently under the rights of national health authorities and NSS. Currently it is envisaged to check accreditation procedures in some countries against the published recommendations, and if applicable endorse these national accreditations. For those countries where there are no national accreditations in place the SMC will help the NSS to either create a national accreditation or will organise site visits with sleep centre accreditation if the NSS requests for this action.

In addition to the accreditation and certification, the SMC will support the development of educational material for future somnologists in Europe through educational courses and written material such as text books. The future concept and the implementation of this high level and interdisciplinary education in sleep medicine, covering all involved fields, will be developed under the auspices of the ESRS board. This way, the ESRS will commit to accomplish its goals with respect to establishing sleep medicine as a particular medical field in Europe.

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## Sleep and Work

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Occupational sleep medicine is a new area of sleep medicine (Belenky and Åkerstedt, 2011). Research in this area has mainly focused on the effects of the psychosocial work environment, work hours, or the physical work environment, or, reversely, on the effects of short or impaired sleep on performance and safety during work.

There are two particularly well-researched areas. Firstly, a number of cross sectional studies has shown that the **psychosocial work environment**, usually “**stress**”, is associated with self-reports of poor sleep (Åkerstedt *et al.*, 2011a). A far lesser number of studies have shown that stress at one point in time, or even a change in stress over time, affects sleep. Results of high or increased stress lead to shortened or impaired quality of sleep. Whereas stress measured in terms of work demands (high work pace, difficult tasks) can have a modest effect, stress measured as stress/worries at bedtime, or as not being able to turn off thoughts of work, has stronger effects. Social support, the buffer against stress effects is also related to sleep quality. There have also been a few studies of polysomnography (PSG – home recordings) in relation to work stress, which point to reduced sleep efficiency, more wakefulness after sleep onset, and an increased latency to stage 3 sleep. There clearly is a need for more real-life studies of work stress and PSG, as we know next to nothing about the relationship between stress and sleep duration (in real life studies), especially in terms of small day-to-day variations in stress that may be related to impaired sleep, and subsequent daily functioning. Moreover, there seem to be no studies (subjective or objective) of different types of sleep and different kinds of stressors, such as, high work demands, threats of being laid off, mobbing, too little to do, etc. A very interesting possibility is that stress or high work load during the day is a promoter of good sleep due to mediation by increased “brain usage” during the day; maybe stress could be a countermeasure to insomnia (provided that stress/worries are not brought to bed)? Furthermore, is good sleep an adequate protection against stress related diseases, and do the latter require disturbed sleep to become established?

The second major area of work / sleep research is **work hours**; mainly, the timing of work (Åkerstedt *et al.*, 2011b). Monks often divide the 24 hour day into 8 hours for work, 8 hours for contemplation / worship, and 8 hours for sleep. King Alfred of Wessex adopted the same view in the ninth century. The first treatise of night work was probably that of Ramazzini (1700), pointing out the plights of bakers and other night workers. The first PSG study, by Foret and Lantin (1972), of train drivers’ sleep as a function of the time of going to bed, is now a classic. It demonstrated that the later the driver went to bed (after 2300 h), the shorter was sleep (up to a noon bedtime). About 7 later studies have confirmed this and added new knowledge. Interestingly, none of the PSG studies have demonstrated disturbed or fragmented sleep but, rather, a shortening by 1.5 – 2 hours after the night shift (2200 h – 0600 h). The reason for this is the sleep truncating effect of the morning circadian rise. Sleep before morning shifts are similarly truncated, but the cause, here, is the alarm clock and the difficulty (of circadian origin) to phase advance bedtime. It appears that as the start of the working day is advanced, sleep duration will be reduced by around 50 minutes for each hour of advance. In contrast to the rather few real-life studies of PSG and shift work, there is a vast number of simulated (laboratory) studies.

While these do provide information, the artificial setting of sleep and work limits their usefulness in understanding the sleep of shift workers. Also available is a large number of questionnaire or diary studies of sleep and work timing. They essentially yield results similar to the PSG studies, but one peculiarity is that shift workers do not seem to complain about sleep in relation to shift work. They may admit to not getting enough sleep, but insomnia items, such as difficulties falling asleep, repeated awakenings, disturbed sleep, etc. seldom differ from ratings of day workers. These ratings do, however, differ immensely from those of insomniacs. These observations lead us to think that sleep is not a main problem in shift work, but rather sleepiness (see below). Indeed, the new diagnosis “shift work sleep disorder” has now dropped “sleep”, since it is now obvious that the active ingredient is fatigue/sleepiness, or “non-restorative sleep”.

The total number of work hours, or overtime, has not been the topic of much sleep research and the results are weak. Often, workers engaged in overtime show fewer problems, due to self-selection (overtime in modern society is often voluntary and carried out at home by individuals with interesting and independent work tasks). However, a shortening of the working day to 6 h (30 h working week) across two years, was shown by (Åkerstedt *et al.*, in prep) to produce a clear improvement of sleep and alertness in the experimental group (400 participants and 400 in the control group). Recently, there have also been indications that commuting time is related to sleep duration, which seems logical. In addition, there appears to be a phase advance of the commute in order to avoid congested roads leading to larger cities. On the other hand, overtime is associated with better sleep than no overtime, and fulltime sleep with better sleep than is part-time work. Selection processes are strongly involved here. An area of work and sleep research that has received little attention, is the effect of the **physical work environment**. Working under uncomfortable environments seems weakly related to reduced sleep quality. Heavy physical work load show similar, weak links. Other factors such as exposure to noise or solvents, vibrations, dust, cold, heat, at work etc., do not appear to have been investigated. Several of the factors mentioned seem to have the potential for affecting sleep. One might also include socio-economic group, where there, again, is limited evidence.

A final area to be considered, here, is the **effect of insufficient sleep** or extended time awake on alertness and performance, or safety at work. In the Royal Navy (UK) falling asleep on watch could be punishable by death in the old days. A considerable number of field and questionnaire studies in the 1970s showed increased sleepiness or fatigue during the night shift, as well as a disproportionate number of reports of falling asleep at work. This has later been demonstrated also in PSG studies, showing that train drivers, truck drivers, paper mill workers and physicians show evidence of actual sleep during work. Experimental studies of late night driving show dangerous levels of sleepiness. There is also ample evidence from questionnaire or interview studies that many road crashes are heralded by increased levels of sleepiness. Studies of road crashes also confirm the excessive risk of having a crash during night driving. The link between accidents and night work is less evident outside of driving, but industrial work has been associated with somewhat higher levels, and a few studies have shown spectacular decreases in patient safety due to on-call work of physicians and the associated sleep loss. The main reason for the effects on sleepiness and accidents may be the impact of work during the circadian trough. The extended time awake in connection with night work (up to 24 hours) is likely to be another contributor, but this has not been formally tested in real life studies. Another factor may be truncated prior sleep.

However, apart from not being formally tested, it seems unlikely that 5.5 – 6 h of sleep terminated at 1300 h (yielding 17 hours of time awake before the end of the night shift) would be a major contributor to night shift sleepiness. However, studies linking sleep loss due to work stress, with sleepiness and accidents, seem to be lacking, as are studies of the importance of good sleep for healthy aging and delayed retirement.

In summary, work stress and work hours have been well studied in relation to sleep, but only in limited terms with respect to the physical work environment, and how this can lead to insomnia. Finally, we know next to nothing about the impact of day-to-day variations in sleep duration and sleep quality on productivity and safety.

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## Epidemiological Sleep Research in Europe

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Epidemiological sleep research, or sleep epidemiology, may be defined as a discipline of how to study the occurrence of phenomena of interest in the field of sleep. Thus, it delineates major principles of study design and data analysis in research into the frequency of occurrence of sleeping habits, sleep disorders and related phenomena in human populations, whether in the community or in different clinical settings.

The oldest epidemiological sleep studies are from the end of the 18<sup>th</sup> century. Clement Dukes from England studied the need of sleep of young children. Other well-known early studies are those by Hertel from Denmark, Bernhard from Germany, and Claparède from France. About 80 to 100 years ago, young children were sleeping 10.5 – 13.5 hours, 15-year-olds 9 – 10 hours, and adults between 7 hours 25 minutes and 8 hours 23 minutes. These figures do not differ significantly from those of the present day.

Epidemiological studies about sleeping habits have been done in Europe since 1960. In these studies the average length of sleep varies between 7 and 8 hours. In Scotland 2446 subjects aged over 15 were inquired. Of the older subjects in the age group 65 – 74 years, 18 percent complained of waking up before 5 a.m. The percentage decreased to 12 % after age of 75. Disturbed sleep was complained by less than 10 % of men aged 15 – 64. In the age group 65 – 74 disturbed sleep was a complaint in 25 % of men. In women the respective percentage was 43 % (McGhie *et al.*, 1962). Since 1970's the length of sleep has remained quite constant. In a large Finnish meta-analytic study (Kronholm *et al.*, 2008) the self-reported sleeping time has decreased by about 18 min during 33 years. At the same time symptoms of insomnia have increased especially in the employed middle-aged population.

By the time of the first European Sleep Research Society (ESRS) congress in 1972 altogether 45 publications were found using the PubMed using the following Mesh terms: ("Epidemiology"[Mesh] OR prevalence OR incidence) AND ("Sleep Disorders"[Mesh] OR "Sleep Disorders, Circadian Rhythm"[Mesh] OR "Snoring" OR "Sleep Apnea Syndromes"[Mesh] OR "Sleep Apnea, Obstructive"[Mesh] OR "Sleep Apnea, Central"[Mesh] OR insomnia OR parasomnia) and limiting the publications into original human studies. The number of such publications increased slowly in the 1970's (10 to 21 publications per year) and started to grow with greater speed at the end of 1980's. In 1990 110 studies were published and the figure increased to over 300 in 2001. Starting from 2008 more than 1000 epidemiological original articles on sleep have been published each year.

In 1980 Elio Lugaresi and his collaborators published the first results of the San Marino epidemiological population based survey in the journal *Sleep*. It was the first large population based study on snoring. Also other sleep disorders were surveyed. The Neurological Clinic of Bologna, Italy, continues to be one of the great schools in clinical and clinical-epidemiological sleep research. Professor Lugaresi and Giorgio Coccagna were among the first persons together with Henri Gastaut to describe obstructive sleep apnea, which they called hypersomnia with periodic breathing. Also the first International symposium "The Rimini Symposium on Hypersomnia and Periodic Breathing" was organized by Lugaresi in 1972. The term "sleep apnea" was

introduced later, in 1975, by Christian Guilleminault, soon after he had moved from France to work with William Dement at Stanford, USA. Lugaresi has been a pioneer in studying hemodynamic changes during sleep apnea, and various movement disorders related to sleep. The description of the Fatal Familial Insomnia is a good example of the clinical-epidemiological skills of Elio Lugaresi.

In France the early epidemiological studies have been conducted mainly in Montpellier. Pierre Passouant (Photo 1) was an excellent neurologist and the teacher of Michel Billiard. Passouant organized the First International Symposium on Narcolepsy in La Grande Motte in 1975. He can be considered as one of the big men and true pioneers in developing the field of clinical sleep medicine, including epidemiological understanding, together with William Dement, Christian Guilleminault, Yasuo Hishikawa, Yutaka Honda, Werner Koella, Elio Lugaresi and Ian Oswald. The latter can be remembered well from his several studies on various aspects of sleep disorders, including treatment of insomnia, the restorative effects of sleep, and role of nutrition on sleep. The debate between Kristine Adam and Ian Oswald on one side, and Jim Horne on the other side was a hot topic in the 1980's.



Photo 1. Pierre Passouant  
(Photo by M. Partinen).



Photo 2. Jörg Hermann Peter  
(Photo courtesy of the family).

After the San Marino studies the first population based epidemiological studies on the prevalence of snoring and sleep apnea were published in the late 1980's in Finland (Telakivi *et al.*), Germany (Jörg Hermann Peter (Photo 2), Thomas Podszus and collaborators), Israel (Peretz Lavie *et al.*), Sweden (Thorarinn Gislason *et al.*) and Denmark (Poul Jennum *et al.*). The prevalence figures varied, depending of the gender and age, between one and six percent which agreed with the results of the Wisconsin population based study that was published in 1993 by Terry Young and her collaborators. European epidemiological studies were an important part of the background for the Madison studies. Many questions in the Wisconsin surveys were based on the questions that had been used in the Nordic surveys which allows good comparisons. At about the same time, in 1989 the first two prospective studies on mortality of sleep apnea were published by He *et al.* and Partinen *et al.*, both on patients in USA. Since that time thousands of studies on sleep apnea have been published, and sleep apnea is now recognized as an important disease. The Italians (the Bologna School, and Luigi Ferini-Strambi and Salvatore Smirne in Milano) have been pioneers in studying cardiovascular consequences of sleep apnea. The first paper on insulin resistance in patients with sleep apnea was published in JSR (Tiihonen *et al.*, *J. Sleep Res.* 1993). It was published at a time when only few people were interested to study relationships between sleep apnea, obesity and glucose metabolism. Other European names in the early history of epidemiology of sleep apnea in Europe include Heikki Palomäki (stroke), John Stradling

# Past – Present – Future

(neck circumference, risk factors, hypertension) and Neil Douglas (RCTs, cognition etc.) and Claudio Bassetti (stroke) among many others. Talking about history of cardiovascular studies on sleep apnea in Europe one cannot forget Marburg. Jörg Hermann Peter was a pioneer in that field and he organized several important meetings on the topic before he passed away in January 2010. Some of the studies that originated in Marburg, are now continued in Gothenburg, Sweden, by Ludger Grote and Jan Hedner. We must recognize the Russian (at that time USSR) and Czech sleep researchers. One of the great names pioneering sleep research was one of the leading neurologists of USSR, professor Alexander Vein. I remember him well from the stimulating discussions that we had during the ESRS congresses and other meetings were we met. He passed away in 2003. Another pioneering Russian person is professor of Psychiatry, Vadim Rotenberg. He moved to Israel in 1990 and he continues to publish. He is known from his theories about sleep deprivation, the search theory, and depression. One of the pioneers in the area of narcolepsy and hypersomnias has been Professor Bedrich Roth (Photo 3) from Prague. He was born in 1919 and he passed away in 1989. He published his first monograph on narcolepsy in 1957. His blue book on hypersomnias with epidemiological data remains as a classic. Sona Nevsimalova and Karel Šonka are two of his talented students.



**Photo 3.** Sona Nevsimalova and Bedrich Roth (Photo by M. Partinen).

Insomnia is the most common sleep disorder. It is very important, and more difficult to treat than sleep apnea. Socio-economically insomnia is even more expensive than sleep apnea. Europeans have published many important epidemiological studies on insomnia. The Swedish (Jerker Hetta, Gunnar Boman and many others), British (Kevin Morgan and others) and Norwegian (Reidun Ursin, Björn Bjorvatn and others) have been active together with Finnish, French and German researchers. Sleepiness is an important issue in occupational medicine and in traffic. In these areas one must remember the studies by Pierre Philip from France and Torbjörn Åkerstedt from Sweden. As for epidemiological studies on narcolepsy many Europeans have been involved in pioneering studies, including Yves Dauvilliers from Montpellier, Christer Hublin from Finland, and the Swiss colleagues.

The first International meeting on epidemiology of sleep/wake disorders was organized in Milano Marittima, Italy, in May 1982 (Photo 4). The proceedings of the excellent meeting were published in the book "Sleep/Wake Disorders: Natural History, Epidemiology, and Long-Term Evolution", edited by Christian Guilleminault and Elio Lugaresi. The first ESRS symposium on "Epidemiology of Sleep Disorders" was organized in 1986 during the 8<sup>th</sup> ESRS congress in Szeged, Hungary. Markku Partinen

acted as the chairperson, and the speakers were Michel Billiard (Montpellier), Raymond Cluydts (Brussels), Markku Koskenvuo (Helsinki), Naomi Richman (London), and Bedrich Roth (Prague).



**Photo 4.** Milano Marittima 1982. Bill Dement and Elio Lugaresi in the middle.

There are many European colleagues who have conducted epidemiological studies in different areas. The list of researchers would be too long, and I have listed only some people that have been important in the history of sleep medicine during its development mainly in the 1980's to 1990's. Many of the grand old researchers have died. Fortunately many others are still active. Happily there are also clear signs that more and more young students, physicians, psychologists and epidemiologists are interested in sleep – and epidemiological studies have a lot to give to increase our understanding of the many facets of sleep. Sleep epidemiology is a rapidly growing field of research. Modern epidemiological methods are used and the studies have changed from simple descriptive studies to well-planned case-control studies and to prospective studies, and to multivariate analytic studies of different associations and risk factors. The European Sleep Research Society has played a very important part in this field.

## Manasseina, Pavlov and the Russian School

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Next year we'll celebrate the 170<sup>th</sup> anniversary of the birth of Maria Mikhailovna Manasseina-Korkunova (1843 – 1903), also known as Marie von Manassein and Marie de Manacéine, a pioneer experimental somnologist. Manasseina published articles in Russian, French and German, and she is sometimes mistakenly referred to as a French or German male scientist. Maria Manasseina worked as a physiologist in St. Petersburg from 1872, performing studies in dog puppies with prolonged deprivation of sleep using forced walking and handling. She came to the conclusion that the main effects originate in the brain itself and are very different from that associated with 20 – 25 days of starvation. Manasseina concluded that sleep is more important for an organism than food, and rejected “the strange opinion regarding sleep as a useless, stupid and even noxious habit”. In 1892, Manasseina published a sizeable hardcover volume entitled “Sleep as one third of human life, or physiology, pathology, hygiene and psychology of sleep”. Its revised and significantly expanded version was later published in English (1897) and Swedish. According to Manasseina, “scientists who regarded sleep as a cessation or diastole of cerebral activity are mistaken, for during sleep the brain as a whole does not sleep at all, it does not stay idle entirely, but only those parts of it which constitute an anatomic substrate of consciousness are under the process of sleeping”. “Sleep is a time for the rest of our consciousness”, she wrote. This book on sleep was the best known of all Manasseina’s works and positive reviews were published in “Philosophical Reviews” and “Science” in 1898.



Photo 1. Maria Manasseina (1860ties) and her original book

Manasseina presented her results at the International Congress of Medicine in Rome (1894). Her works had a tremendous impact on sleep science. In 1896 two American psychologists, G. T. V. Patrick and J. A. Gilbert, clearly inspired by Manasseina’s pioneer work, performed the first study of sleep deprivation in humans, and in 1898 three Italian investigators, L. Daddi, G. Tarozzi and C. Agostini, also inspired by her studies, performed more detailed investigation of sleep deprivation in dogs. Later, at the beginning of the 20<sup>th</sup> century, the Japanese scientist K. Ishimori and the

French scientist H. Piéron, independently made the first attempts to explore the accumulation of sleep substances (“hypnotoxins”) in a sleep-deprived organism and their transmission to non-deprived animals (donor-recipient transfusions). Being influenced by Manasseina’s work, both researchers referred to her book and followed Manasseina’s method of sleep deprivation in their experiments, also on dogs (see Kovalzon, 2009, for the references).

It is well known that the great Pavlov was very much interested in sleep problems, considering sleep as the key to his theory of higher nervous activity. Everyone knows his definition of sleep as a “spreading cortical inhibition”. After the discovery of paradoxical (REM, dreaming) sleep, it seemed that Pavlovian theory had become hopelessly obsolete in this respect. Indeed, the idea of the creation of the “physiology of dreaming” could not come to his mind. However, if we take into account slow wave (NREM, orthodoxic) sleep, “sleep in general”, and recall some recent discoveries, such as the strong activation of inhibitory neurons and the release of their mediators – GABA, galanin, adenosine, starting in local hypothalamic areas and gradually spreading through the neocortex; or the extreme hyperpolarization of thalamo-cortical neuronal network which, being alternated with brief depolarization periods, predominates during this state, we can hardly come to the conclusion that this fully intuitive idea of Ivan Pavlov about sleep was completely wrong.



Photo 2. Ivan Pavlov (1849 – 1936)

At the end of his long life, in 1935, Pavlov wrote: “It is clear that our diurnal working is nothing but a sum of irritations that is the cause of a correspondent sum of exhaustion and when this sum of exhaustion comes to the end it induces automatically, by internal humoral way, the inhibitory state followed by sleep”. This formulation could be regarded as prophetic – it actually sounds quite contemporary.

Russian-originated scientists and their ideas have certainly played an important role in history of sleep science. It would be sufficient to remember that Nathaniel Kleitman (1895 – 1999) was born in, and graduated from a secondary school in, Kishinev, Russia (now in the Republic of Moldova). Russian was his native language, and it was a paper of the Russian authors M. P. Denisova and N. L. Figurin “Periodic events in children sleep” (1926) which became the starting point for the revolutionary discovery of REM sleep in 1953 (Dement, 2001).

Despite the great detriment caused to Russian physiology by the victory of dogmatics (approved by Stalin) at the so-called “Pavlovian session” in 1950, during the post-Stalin period (60ties – 80ties) basic studies of the mechanisms of sleep-

# The Founders of European Sleep Research and Sleep Medicine

wake regulation were performed in the Soviet Union on a large scale in dozens of laboratories. Several names are particularly noteworthy: Nikolay Grashchenkov (died 1966) who organized the Laboratory of Nervous and Humoral Regulations at the USSR Academy of Sciences in Moscow; his disciples Aleksandr Vein (died 2003), the founder of sleep medicine and human sleep physiology in Russia, and Lev Latash (died 2002, in the U.S.A.); the living authority Aleksandr Shepoválnikov, the author of the first Russian monograph "Activity of the sleeping brain" (1971) who is actively working as before at the Sechenov Institute of Evolutionary Physiology and Biochemistry, Russian Academy of Sciences, St. Petersburg; three other sleep researchers from the latter city: a known specialist in sleep evolution Ida Karmanova (died 2005) from the same Institute, who published two books in English (Karmanova, 1982; Karmanova, Oganessian, 1999) and a book of poetry "Maski sna" (Masks of sleep), 1991; the late Natalia Moiseeva, a specialist in human sleep EEG from the Institute of Experimental Medicine, Academy of Medical Sciences; the late Nikolay Demin, specialist in sleep biochemistry, from the Pavlov Institute of Physiology, Academy of Sciences; Aleksandr Kogan (died 1989), the chief of the physiology school in Rostov-on-Don; three latter researchers were the authors of an early Russian monograph on sleep (Demin *et al.*, 1978); and Tengiz Oniani (died 2012), the chief of the Georgian sleep school, Tbilisi. The first all-night human sleep recording in Russia was performed in 1968 at the above-mentioned Grashchenkov lab by Nikolay Yakhno (1<sup>st</sup> Moscow Medical University), Lev Sumskiy (Sklifosovskiy Institute of Emergency Medicine, Moscow) and Vadim Rotenberg (the retired senior lecturer of Tel-Aviv University, Israel) using an old Alvar electroencephalograph. Several international scientific conferences on sleep took place in Leningrad and Tbilisi, and several world known sleep researchers were invited, including Michel Jouvet, Ian Oswald, Ismet Karacan, Wilse Webb and Allan Hobson. As the most important contribution, the discovery of uni-hemispheric slow wave sleep in dolphins by a group of researchers from Severtsov Institute, Russian Academy of Sciences, Moscow, led by Lev Mukhametov should be mentioned, which took place at the beginning of the 1970s. A 35 year experience of the study of dolphin sleep was recently reviewed by Oleg Lyamin *et al.* (2008).

During the 1990s, after the breakdown of the USSR and a disastrous decline in basic science support in Russia, the greater part of fundamental sleep research was discontinued. However, during the 2000s research gradually revived in several labs in Moscow, St. Petersburg and Rostov-on-Don. A new lab for the study of neurobiology of wakefulness and sleep was established at the Institute of Higher Nervous Activity and Neurophysiology, Russian Academy of Sciences, Moscow. This is led by Vladimir Dorokhov, Ph.D., and recently joined the ESRS Consortium of Sleep Labs. The professional organization for somnologists, the somnology section of Pavlovian physiological society (Russian Somnological Society) was founded in 2007, and is led by Vladimir Kovalzon (Severtsov Institute Ecology/Evolution, Russian Academy of Sciences, Moscow), Vladimir Dorokhov (Institute Higher Nervous Activity/Neurophysiology, Russian Academy of Sciences, Moscow) and Yevgeniy Verbitskiy (Southern Scientific Center, Russian Academy of Sciences, Rostov-on-Don). This organization unites mostly experimental and basic human sleep researchers and manages International workshops e.g. "sleep as a window to the world of wakefulness" (supported by IBRO) every second, odd-numbered year. The 6<sup>th</sup> workshop successfully took place in October 6 – 8, 2011, in Moscow with participation of 65 students from 7 European countries. Also, sleep medicine is greatly developing, several dozens of clinical centers were

created, including more than 20 centers in Moscow, the most important of them led by Alexandr Kalinkin, Mikhail Poluektov, Roman Buzunov, Gennadiy Kovrov and Mikhail Agaltzov. The National Society of Pediatric Sleep Specialists was founded in 2007, and the National Society on Somnology and Sleep Medicine was founded in 2010, both founded and led by Yakov Levin (the 1<sup>st</sup> State Medical University, Moscow), and units mostly medical doctors. After the sudden death of Prof. Levin on March, 31, 2012, both societies are now chaired by Mikhail Poluektov, M.D. These latter organizations now support conferences entitled "Actual problems of somnology" in the even-numbered years, which were started by Prof. A. Vein in 1998. The 8<sup>th</sup> Conference will take place in Moscow, November 22 – 23, 2012. Integration of all the societies into the Russian Sleep Federation is now under discussion among the members. A state-of-the-art review of basic somnology was recently presented in Russian (Kovalzon, 2011). So despite all the historical difficulties, Russian somnology is alive and developing in the second decade of the 21<sup>st</sup> century.



**Photo 3.** A group of Russian somnologists at the last ESRS Congress in Lisbon, 2010. From left to right: Igor Timofeev (Laval, Québec), Vladimir Dorokhov (Moscow), Ivan Pigarev (Moscow), Roman Yassenkov (Leiden), Vladimir Kovalzon (Moscow).

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## Von Economo and the Hypothalamus

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Towards the end of the 19<sup>th</sup> century two novel ideas appeared in the field of sleep research. The first idea conceptualized sleep as an active process, originally proposed by Purkinje (1846) and Trömner (1912). The second idea was to localize distinct areas as active “sleep” and “wake” centers in the brain as suggested by observations from diseases with focal brain damages (including encephalitis, stroke). In this context Constantin von Economo introduced his novel concept of localized “sleep” and “wake” centers in the hypothalamus into sleep in 1916, an idea that was first brought up by Mauthner 1890 and Trömner 1912.

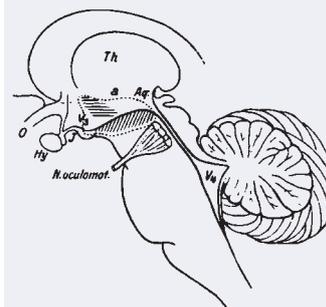


**Figure 1.** Portrait of Constantin von Economo (Vienna, late 1920) printed with permission from Triarhou LC, Constantin von Economo (1876–1931), *J Neurol* 2007 254:550–551

Constantin von Economo was born 1876 in Braila, Romania as the fifth child of aristocratic Greek parents. He started to study engineering but changed to medicine soon and was well trained at the best European Universities for Medicine (Strasbourg, Munich, Berlin, Trieste, Vienna). His broad education in physiology, neurology, psychiatry and comparative neuroanatomy set the ground for outstanding contributions to various research fields. Besides his well known discovery of encephalitis lethargica, he published the clinical spectrum and the neuroanatomical hallmark of substantia nigra lesions in post-encephalitis Parkinson. Furthermore, his knowledge in mechanical engineering enabled him to develop novel neuromorphologic techniques that provided new insights into the cytoarchitecture of the human cortex. Until today von Economo’s studies on encephalitis lethargica are regarded as the most influential work of European sleep research. He was nominated for the Nobel Prize for the discovery of encephalitis lethargica three times but he died suddenly in 1931 at the early age of 55 from cerebral infarction.

Constantin von Economo came across his pioneering discovery of localized sleep and wake centers in the brain during his studies on encephalitis lethargica (EL) that involved Europe in a first small epidemic in 1916. At that time von Economo worked as a military doctor at the Vienna General Hospital where he faced patients with unusual clinical presentations consisting of acute fever followed by a variety of neurological symptoms. As a

gifted clinician he was able to recognize that severe somnolence together with oculomotor signs was the linking core feature in all of these patients. It took him only seven cases and five months to discover a novel form of encephalitis and to conclude that lesions “rostrally from the nucleus of the third cranial nerve in the transitional parts of mesencephalon to diencephalon” caused a severe form of sleepiness (“...es handelt sich, wenn ich so sagen darf, um eine Art von Schlafkrankheit...”) (v. Economo, 1917; Triarhou, 2006). Based on further clinical observations he subsequently described the full clinical spectrum of a new form of encephalitis, encompassing a somnolent-ophthalmoplegic, a hyperkinetic and an amyostatic-akinetic form. Von Economo was not only an excellent clinician but also an outstanding neuroanatomist and neuroscientist with a unique capacity to link clinical observations with neuropathological findings. This clinical-neuropathological approach allowed him not only to conclude on the post-infectious etiology and differential diagnosis of encephalitis lethargica, but also to postulate a dual model of brain’s sleep and wake regulation. In a first series of studies on brains of patients who died during the acute stage of EL von Economo described neuroanatomical features that were essentially different from already known purulent or hemorrhagic type of encephalitis. Numerous infectious foci were scattered throughout the deep grey matter of the brain at various stages of neuronal loss but in the absence of profound necrosis. The most affected areas were substantia reticularis, thalamus, basal ganglia, the cerebral aqueduct and the infundibular area, an area that encompasses various hypothalamic nuclei. Similar to the clinical picture these rather diverse neuropathological features were neither uniform nor pathognomonic for EL. Again it is the merit of von Economo to recognize that focal infiltration of grey substance of the brainstem and diencephalon was a consistent core pattern in patients suffering from the somnolent-ophthalmoplegic form of EL. It is exactly this finding that led him to conclude that a sleep regulation center (“Schlafsteuerungszentrum”) definitely exists, closely localized to the centers that regulate temperature, blood pressure and water and salt (von Economo, 1925). Remarkably the very few patients not affected by prominent sleep need remained free of any grey matter involvement. Patients who survived the acute stages of EL presented an extraordinary consistent clinical picture. They either remained hypersomnolent or converted into a state of severe insomnia. Based on the histopathological findings of these prototypes von Economo extended his concept of a sleep-regulation center, distinguishing two distinct areas, one rostral diencephalic-mesencephalic part responsible for sleep (“sleep part”; “Schlafteil”) and its posterior counterpart responsible for waking (von Economo, 1926).



**Figure 2.** von Economo’s drawing of “sleep” and “wake” centers in the upper brainstem. The anterior “sleep part” (horizontal lines) and posterior “waking part” (diagonal lines) are centered in a dotted area at the diencephalic-mesencephalic junction. Abbreviations: Aq, aqueduct; Hy, hypophysis; J, infundibulum; O, optic chiasm; Th, optical thalamus; V3, third ventricle; V4, fourth ventricle. Reprint with permission from Triarhou L.C. 2006 (original drawing in von Economo C, *Die Pathologie des Schlafes*, in: Bethe A., Bergmann G.V., Embden G., Ellinger A. (Eds.), *Handbuch der Normalen und Pathologischen Physiologie*, Bd. 17: *Correlationen III*, Verlag von Julius Springer, Berlin, 1926, pp. 591–610).

# The Founders of European Sleep Research and Sleep Medicine

In 1919, three years after his seminal deductions of a localized sleep center von Economo demonstrated the critical role of substantia nigra lesions for parkinsonism derived from studies of two amyostatic-akinetic encephalitis cases. In the same year Tretiakoff independently described nigral degeneration as the neuropathological hallmark of Parkinson's disease (Triarhou, 2006).

Von Economo's conclusions on localized sleep and wake centers survived for nearly a century now. The validity of his concepts has been ultimately confirmed by WR Hess who demonstrated the active role of the thalamus and hypothalamus in sleep wake regulation. The hypothalamus is now a well established key structure harboring the relay neurons that control sleep and wake by hormonal and autonomic downstream signals. Many nuclei and sub-nuclei in the preoptic (e.g. VLPO), median and posterior area of hypothalamus has subsequently been demonstrated to mediate exactly the sleep or wake promoting functions as predicted by von Economo. Modern sleep medicine has widely adopted von Economo's ideas and attributed dysfunctions of sleep and wake centers as a major cause of sleep-wake disorders. The attention has been focused on the hypothalamus to explain some sleep disorders as focal brain disorders. This notion has been impressively confirmed by the discovery that narcolepsy-cataplexy is caused by a deficiency of the hypothalamic hypocretin/orexin system.

The exact infectious agent of EL has never been identified and is still a matter of debate for current cases with the EL phenotype. The worldwide epidemic of EL of 1916 to 1927 coincided with the influenza pandemic in 1918 and it was speculated that influenza virus was the causative agent. Von Economo himself doubted this hypothesis and recent postmortem investigations appear to confirm his doubts as they failed to find virus RNA in archived EL brains (McCall, 2001). Since the 1926 epidemics, only sporadic cases of EL have been described, the largest case series reported by Dale and colleagues (Dale, 2004). EL phenotype in his cases followed pharyngitis, and the majority of these patients had high antistreptolysin titers, CSF pleocytosis and intrathecal positive oligoclonal bands, suggestive for an autoimmune reaction. Dale et al. proposed that sporadic EL was one form of poststreptococcal autoimmune disorders (PAD), similar to the pathogenesis of Sydenham chorea. Elevated antibodies reactive against neurons of the basal ganglia (ABGA) in most of these patients appear to support this assumption.

Meanwhile, von Economo's concept of circumscribed sleep and wake centers has been extended and refined to widespread sleep and wake networks with complex reciprocal interactions. However the essential idea of localizing sleep and wake functions will survive and it has major implications for modern sleep medicine providing advances for new therapeutic options.

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## Henri Piéron, the Pioneer of 20<sup>th</sup> Century Sleep Research

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During the past century, only two researchers published world-famous, encyclopedic works devoted to sleep. The first was Henri Piéron, who published his doctoral (PhD) thesis in 1912, entitled "Le problème physiologique du sommeil" (Masson Ed., Paris, published in book form in 1913). Although this work has often been quoted, it remains almost completely untranslated. In addition to summarising his own results, Piéron provided an exhaustive overview of the then-existing sleep literature (1229 references), a feat for those days. The second researcher was Nathaniel Kleitman, whose two major editions of *Sleep and Wakefulness* (published in 1939 and 1965) contained 1434 and 4337 references, respectively.

Henri Piéron (Fig. 1) was born in Paris in 1881. He studied at the Sorbonne, and although his first degrees (a 'licence' and then an 'agrégation') were in philosophy, he soon fought against the idea that psychology, his main interest, should be subordinated to philosophy. As early as 1907, at the age of 26, and as the founder of French experimental psychology, he claimed that psychology should be the science of behaviour, and that it should be integrated into the biological sciences. Accordingly, when he obtained a rostrum at the Collège de France at the age of 42, he used as an epigraph the statement of Johannes Müller: "Nemo psychologus nisi physiologus": "One is not a psychologist who is not also a physiologist".



Figure 1. Henri Piéron (Photo courtesy of Presses Universitaires de France).

Although Piéron had many successive and/or simultaneous interests in his career, his first interest was sleep, which he studied from invertebrates to vertebrates (rest-activity cycle) and in mammals up to Man (the species!). Although his main experiments were performed on dogs, his earliest research concerned man and was primarily devoted to the adaptive properties of body temperature cycles. In particular, these experiments examined the modalities of the progressive appearance of inverted temperature rhythms in night-time workers (Toulouse and Piéron, 1907).

Piéron began to study the effects of sleep deprivation in 1907. He worked on dogs which were subjected to complete sleep deprivation for up to 6 days; they were kept awake during the daytime by tying them to the wall using a very short leash that prevented them from lying down, and at night by stimulation and

walking. He first looked for histological disturbances in the brain. Among several structures studied, only the large pyramidal cells of the prefrontal cortex showed significant abnormalities, and these were reversed after sleep recovery.

Piéron wrote, "I have provisionally left aside the question of the mechanism of sleep, focusing exclusively on its causes... and under what circumstances it is possible to experimentally produce a sleep state" (p 308) (Piéron, 1907b). "I asked if it was possible to transfer the imperative need for sleep from an animal in which the imperative need has been established by sleep deprivation to another, normal animal" (p 343) (Piéron, 1907a). To do this, he took cerebrospinal fluid (CSF) and serum samples from defibrinated and centrifuged blood obtained from deprived dogs, and injected them into non-deprived control dogs. He wrote about the possible synthesis of 'hypnotoxic factors,' "whose nature we cannot presume to anticipate in any way" (p 342).

The first results, reported in 1907, were disappointing. After transferring defibrinated blood either into the femoral artery or intravenously, Piéron wrote: "I was unable to obtain evidence for the existence...of a hypnotoxic substance capable of clearly reproducing the need for sleep which can be so clearly evident in sleep-deprived animals".

Hesucceeded, however, in 1910, when he intracerebroventricularly injected homogenized cerebral hemisphere extracts, serum, and CSF into non-deprived dogs (after first removing the same volume of CSF from the recipient animals). "In these three animals, extremely accentuated sleep phenomena were observed" (p 1108) (Legendre and Piéron, 1910). This research also confirmed the existence of disturbances in pyramidal cells of the prefrontal cortex in deprived animals. The control experiments (injection of extracts from non-deprived animals into non-deprived animals) mainly induced photophobia, although slight drowsiness was also observed. Finally, two different experiments from 1910 showed that neither osmotic factors, nor CO<sub>2</sub>, promoted the appearance of sleep.

In 1911 and 1912, Legendre and Piéron tried to define the characteristics of the sleep factor. At 37°C, CSF and serum induced sleepiness, as they did when they were heated to 55°C. In contrast, after heating to 65°C, they no longer had any effect. After being treated for one hour with bubbling oxygen, the factor also lost its activity, whereas the extract maintained its power after being maintained in the dark at 15°C for 28 days. When dried out with alcohol and dissolved in physiological water, the extract induced inertia but no clear-cut sleepiness. "This toxin is soluble in water, insoluble in alcohol, destroyed by heating to 65°C or by prolonged oxidation, and is non-dialysable; all of these are features that do not allow one to hope for its isolation at the moment" (p 304) (Legendre and Piéron, 1912).

Despite the early date of Legendre and Piéron's work, and even though their contemporary K. Ishimori published similar results in Japanese in 1909, these experiments were not replicated until the 1970s, when J. R. Pappenheimer's group identified the 'Factor S', which is active even when transferred to other species. With respect to the importance of the sleep factor for sleep induction, Piéron favoured the notion of an anticipation process, stating: "It is not because we are intoxicated, or exhausted, that we sleep, but rather that we sleep in order to avoid these states" (p 442) (Thesis).

At the end of the research leading to his thesis, Piéron gave a definition of sleep that is still valuable today: "Sleep is a periodically necessary state, with a periodicity that is relatively independent of exterior circumstances, and which is characterised by the suspension of the sensory-motor relations that unite the individual with his environment..." (p 3) (Thesis).

# The Founders of European Sleep Research and Sleep Medicine

After leading a highly active intellectual life devoted to sensory processes and to applied psychology, and after having published numerous books on these and other topics, and having been honoured by national and international institutions, Henri Piéron died in 1964.

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## Michel Jouvét and the Lyon School

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Michel Jouvét was born in 1925 in Lons-le-Saunier, France. After the Second World War, he was admitted as a resident in neurosurgery in 1951. In 1953, he started neurophysiological research in the department of physiology of the Lyons Medical School. He "borrowed" a 4 channels Alvar EEG machine to record the cortical EEG of cats. Professor Paul Dell, a distinguished neurophysiologist working in Paris taught him how to cut the brain stem of a cat to realize the "cerveau isolé" preparation of Frédéric Bremer, the well-known physiologist from Brussels. Finally, he was so interested in experimental neurophysiology that he decided to go in September 1954 for one year in Professor Magoun's laboratory in Long Beach (USA). There, he developed a method to record EEG in chronically implanted cats. At the end of 1957, he decided together with François Michel, a young intern to study the mechanisms of habituation of cortical arousal in chronic decorticated cats, in cats with large lesion of the reticular formation, or in mesencephalic or pontine cats. As a next step, they decided to record the neck muscle activity (EMG) to obtain some objective motor reaction which could habituate easily in mesencephalic cats. They also implanted electrodes in or very near the oculomotor (VI) nuclei. During 3 to 6 hours EEG recordings, they were surprised to see, every 30 to 40 minutes, a periodic appearance of "spindle-like" activity in the pons, which coincided with the total disappearance of the EMG of the neck. These curious episodes lasted about 6 minutes and occurred periodically every 50 minutes. They were faced with some kind of "hindbrain (rhombencephalic) sleep" which contrasted with slow-wave sleep (SWS) (Jouvét and Michel, 1959) (Fig. 1). Very quickly they started similar polygraphic recording in intact cats. They were surprised to see that the cortical activity was similar to that seen during waking but that the threshold for arousal was much increased. This was a paradoxical finding. At this time, W. C. Dement had just published his classical paper on "REM sleep" (Dement, 1958). Michel Jouvét's results clearly indicated that "REM sleep" was a third vigilance state very different from W and SWS. Since PS still existed in pontile cats, it could be described as rhombencephalic sleep, whereas slow-wave sleep could be described as telencephalic sleep. Michel Jouvét's results also indicated that "dreaming" was triggered by a structure located in the lower brainstem.



**Figure 1.** Michel Jouvét presenting one of his cats in 1965



**Figure 2.** Michel Jouvét in his office at Rockefeller University in Lyon in 1962



**Figure 3.** Michel Jouvét teaching on the mechanisms responsible for sleep at the Loyola University in Chicago in 1969

The hypothesis that slow wave sleep depends upon the cortex and paradoxical sleep depends upon the rhombencephalon is still valid today. PS is also found in animals without eyes (as the mole) and in birds which do not move their eyes (as the owl). This is why he believed that the term of REM sleep is probably not the best to describe this strange state of sleep which function is still unknown.

Then, the growing laboratory of Michel Jouvét (Fig. 2) started to delimit the structures responsible for the triggering of paradoxical sleep by local coagulation of the pontine reticular formation. Together with his collaborators, he observed that the lesions destroying the dorsolateral part of the pontine tegmentum could abolish selectively paradoxical sleep (PS) without altering SWS. They further showed that smaller lesions of this area induced a state of PS without muscle atonia (Jouvét, 1962). Later, in 1979, he described with Jean-Pierre Sastre, the oneiric behaviours expressed by cats, indicating that cats also dream. In 1986, REM sleep behaviour disorder was discovered in humans and it was proposed that these patients might have a lesion of the pontine generator of atonia discovered by Michel Jouvét. It was also shown at that time that atropine, a cholinergic antagonist had a potent and selective suppressor effect, and eserine a facilitatory effect on PS when given in pontine cats, introducing the notion that cholinergic mechanisms play a key role in PS generation.



**Figure 4.** A oneiric drawing of Michel Jouvét in 1948 before his discovery of paradoxical sleep

The next major contribution of Michel Jouvét's laboratory has been the introduction of the monoaminergic theory of sleep and waking first published in 1972 (Fig. 3). In 1999, Michel Jouvét resumed his 40 years of research on serotonin writing that it was similar to a "popular love story". First, the encounter of a mysterious monoamine without a face, then the honeymoon, followed by a divorce and later by reconciliation. After the mapping of the monoamines in 1964 by Dalhstrom and Fuxe, Michel Jouvét and co-workers demonstrated by lesions and pharmacological approaches that the monoamines play a key role in sleep. Serotonin (5-HT) was first believed to be a true neuromodulator of sleep because the destruction of 5-HT neurons of the raphe system or the inhibition of 5-HT synthesis with p-chlorophenylalanine induced a severe insomnia which could be reversed by restoring 5-HT synthesis. However the demonstration that the electrical activity of 5-HT perikarya and the release of 5-HT are increased during waking and decreased during sleep was in direct contradiction with this hypothesis. More recent experiments suggest that the release of 5-HT during waking may initiate a cascade of genomic events in some hypnogenic neurons located in the lateral preoptic area. Thus, when 5-HT is released during waking, it leads to a homeostatic regulation of slow-wave sleep (Fort *et al.*, 2009). Today, the role of serotonin in sleep is still mysterious...(Fig. 4)

# The Founders of European Sleep Research and Sleep Medicine

Another major contribution of Michel Jouvét is the study of the phylogeny of sleep. Together with a young medical student, Daniele Mounier, who became his first wife in 1961, he failed to find any evidence of paradoxical sleep in the tortoise and concluded that probably reptiles in general were capable only of light sleep. Among birds, however, he saw a beginning of paradoxical sleep, albeit very brief. In the mammalian order, all the animals that have been studied, from the mouse to the chimpanzee, spend a substantial portion of their sleeping time in paradoxical sleep (Jouvét-Mounier *et al.*, 1970). He also was a pioneer in the study of the ontogeny of sleep. He found out that ontogeny does not follow phylogeny. In the mammals (cat or man) light sleep does not occur until the nervous system has acquired a certain amount of maturity. A new-born kitten in its first days of life spends half of its time in the waking state and half in paradoxical sleep, going directly from one state into the other, whereas in the adult cat there is almost invariably a transitional period of light sleep (Fig. 5).



**Figure 5.** A drawing of one of his dream by Michel Jouvét named "le Jongleur de notre dame"

I always recall Michel Jouvét saying that the best way for a physiologist to lose his reputation is to advocate a function for paradoxical sleep! He also often said that there are as many hypotheses on the function of paradoxical sleep as researchers working on it. He nevertheless did not resist to emit his own hypothesis. His theory was based on the fact that homozygous twins separated at birth and reared in different environments still retain identical psychological idiosyncratic reactions. He proposed that the function of paradoxical sleep is to maintain an identical psychological profile. He made the hypothesis that the patterns of ponto-geniculo-occipital (PGO) activity would be responsible for this function, together with the theta activity of the hippocampus and fast cortical EEG. This programming would activate all the brain including the pyramidal motor system while movements would be suppressed by the system controlling muscle atonia (Jouvét, 1975). Michel Jouvét also maintained during his entire career a clinical activity. Together with Héléne Bastuji he discovered the waking effect of modafinil and in 1983 for the first time used it to treat idiopathic hypersomnia and narcolepsy with modafinil (Bastuji and Jouvét, 1986) (Fig. 6). After Michel Jouvét retired in 1998, two laboratories headed by Jian-Sheng Lin and Pierre-Hervé Luppi were created in Lyon. They are following the path of Michel Jouvét and are identifying more and more deeply the mechanisms controlling the sleep-waking cycle and that of the function of sleep.



**Figure 6.** A drawing of one of his dream by Michel Jouvét named "The anatomy class" from Rembrandt. It looks like he was dreaming that his cats were killing him...

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## W. R. Hess and the Swiss School

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With his novel concept on sleep regulation which he presented in 1924 (Hess, 1924) and later his diencephalic stimulation experiments using depth electrodes in awake and freely moving cats, Walter R. Hess ushered in a new era of sleep research and laid the foundation for a Swiss sleep research tradition which is still continuing. Starting from a keen interest in the central control of the autonomic (vegetative) system, to which he attributed a leading role in regulating sleep, he challenged the then prevailing doctrine of sleep as a basically passive phenomenon. According to E. Trömmner's idea at the beginning of the 20<sup>th</sup> century the central sleep organ was confined to prevent sensory stimuli from reaching the conscious perception (Hess, 1924). N. Kleitman too held that sleep was due to inactivity of the central nervous system as a consequence of reduced peripheral input (Thorpy, 2001), and F. Bremer in 1935 gave experimental support to the so called "deafferentation theory" stating that shutting off the afferent inputs to the cortex was the essential mechanism of sleep (Thorpy, 2001). Conversely, Hess postulated that sleep was a well-coordinated **active process** rather than the mere absence of wakefulness. As such, sleep was put by him in contrast to the passive state of general anaesthesia (Hess, 1924). He was inspired by observations during sleep such as the sophisticated mechanism of selective elevation of sensory thresholds (letting through certain meaningful signals to reach cortical level), or the gentle tonic action of the orbicularis oculi muscle of sleep associated eye closure as active phenomenon (Hess, 1944). He was also impressed by the Encephalitis cases of C. von Economo, who later reported, apart from the many patients with long lasting somnolence, also cases with insomnia that turned out to present with more rostral hypothalamic lesions (see Khatami *et al.* in this issue). These cases corroborated the existence of an active "sleep centre" in the diencephalon. For Hess a "centre" was a neural apparatus which regulates a physiological function, i.e. a neural network rather than just a solitary cluster of neurones (Akert, 1981).



Figure 1. Walter R. Hess (1881 – 1973).  
(Photo courtesy of the family).

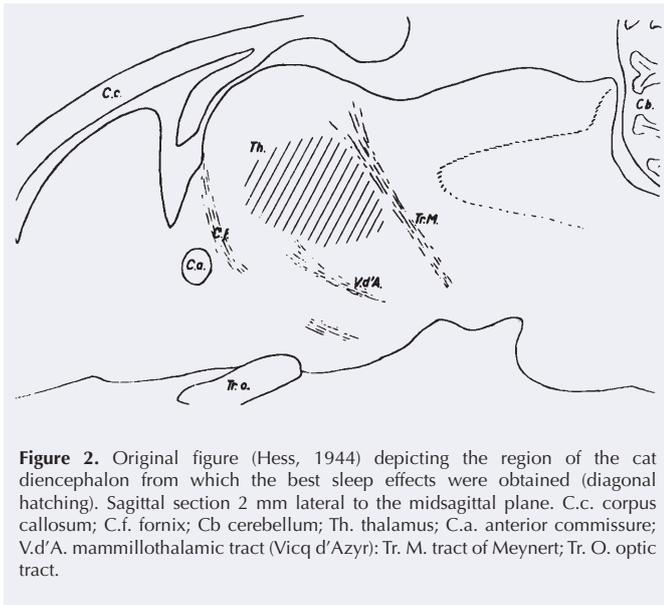
In addition, Hess had the visionary concept of an autonomic nervous system which **modulates higher brain areas** such as the cortex and which in this way would regulate readiness i.e. would silence the psychic functions during sleep (Hess, 1924). However, the suspected ascending ultrafine, unmyelinated fibres needed to convey this autonomic modulation escaped the microscopic

techniques available at the time. Aiming at these postulated but invisible thin fibres, Hess subsequently developed his unique depth stimulating technique (see below). In 1949 Moruzzi and Magoun published their seminal paper on the ascending reticular activating system (Thorpy, 2001). Although these authors initially interpreted their findings as speaking in favour of sleep as a passive phenomenon, it conformed well to Hess's concept about wakefulness and sleep. And later it turned out that the cortex indeed received ascending input carrying modulating transmitters which influence the impulse traffic within cortical grey matter (Akert, 1999).

An experimental breakthrough came in the late 1920's and 1930's, with his stimulation studies in freely moving cats with electrodes located at precisely defined anatomical sites, enabling to explore systematically the autonomic neuronal networks of the diencephalon and adjacent regions (Akert, 1999). In order to appraise Hess's stimulation experiment, his special stimulation technique must be considered. With the intention to target the small, thinly myelinated and unmyelinated fibres of the autonomic system of the periventricular grey, he developed a special low frequency (4 – 12 Hz), damped stimulus form which he labeled "interrupted direct-current (DC) stimulation": Rather than brief (< 0.5 ms) square-wave impulses, Hess used stimuli of long duration, typically 12.5 or 25 ms, with ramp-like, attenuated upward and downward slopes (Akert, 1981). The trains of stimulation lasted 30 seconds or one minute and bipolar or monopolar stimulation was used. He finally achieved to be effective at minimal threshold and with minimal current spread, thereby avoiding or minimizing stimulating effects on thickly myelinated fibres that might obscure the effects on the autonomic system. Subsequently, he went to great effort to precisely localize the anatomical site of stimulation. Using electro-coagulation by the stimulation electrodes, he produced small lesions and the degenerated nerve fibres emanating from the microcoagulated stimulation points could be traced (Akert, 1981, 1999).

The experiments were carried out under strictly standardized conditions, and great care was taken to make the animals feel at ease and in a normal excitatory state. For instance, before starting an experimental session, Hess would feed the cats to create a confiding atmosphere, which he considered particularly important when stimulus induced sleep was a possibility. Typical stimulus induced sleep, which Hess accepted to be like physiological sleep, occurred **after** the (sometimes repeated) stimulation train, and the cat first looked for a suitable sleeping place, and then curled up comfortably before falling asleep. Furthermore, like in physiological sleep, the cat could readily be re-awakened at any time by e.g. the smell of fresh meat, to easily fall back into sleep again when left undisturbed, indicating even the presence of a physiological sleep inertia phenomenon. Positive stimulus sites were less circumscribed than those of other autonomic effects revealing a relatively widespread region extending from the medial thalamus towards the caudate nucleus (Hess, 1944). Sleep-like behaviour without the full set of "physiological" sleep was found in adjacent areas. Hess assumed that in his "hypnogenic zone" the stimuli excited a hierarchically upstream sleep network of the "trophotropic" component of the autonomic system. The fact that by enhancing stimulus intensity, opposite effects (i.e. arousal) were usually achieved at the same sites (Hess 1944), was not surprising, because other co-localized networks with opposite ("ergotropic") functions were expected to be situated in the medial thalamus (midline nuclei / intralaminar system of the central grey). For this reason, insomnia could not be expected from lesions at these thalamic sites.

# The Founders of European Sleep Research and Sleep Medicine



**Figure 2.** Original figure (Hess, 1944) depicting the region of the cat diencephalon from which the best sleep effects were obtained (diagonal hatching). Sagittal section 2 mm lateral to the midsagittal plane. C.c. corpus callosum; C.f. fornix; Cb. cerebellum; Th. thalamus; C.a. anterior commissure; V.d'A. mammillothalamic tract (Vicq d'Azyr); Tr. M. tract of Meynert; Tr. O. optic tract.

Hess's findings with regard to sleep were controversial from the very beginning. Because of the widespread localization of the "hypnogenic zone", and in view of the variable, sometimes rather long latencies between the stimulus train and actual sleep, it was criticized that Hess's cats fell asleep spontaneously (Akert, 1999). Also, the findings were not replicated with other than Hess's stimulation technique. Only by using identical methodology, particularly the damped low intensity, low frequency stimulus trains, the findings were later replicated and supplemented by EEG recordings with typical sleep patterns by Konrad Akert together with Werner Koella and Hess's son as electroencephalographer (Akert *et al.*, 1952). The relatively circumscribed sleep-active neurones of the ventrolateral preoptic nucleus of the hypothalamus were only discovered in the 1990s by Koyama and Hayaishi (Koyama and Hayaishi, 1994) and Sherin *et al.* (Bassetti and Valko, 2006), the destruction of which caused long lasting insomnia. Recent observations in patients have, however, brought up again a likely role of the medial thalamus in sleep, where networks with opposite effects are postulated (Tinuper *et al.*, 1989, Bassetti and Valko, 2006).

Sleep was just one aspect of the autonomic nervous system Hess was interested in. The convergence of visceral, olfactory, and gustatory inputs to the diencephalon and the strong autonomic and extrapyramidal motor output seemed to predispose this brain region for regulatory mechanisms of motivational and instinctive behaviour. The representation of the **autonomic functions in the hypothalamus** that Hess discovered, placed these functions in two anatomical zones: the "trophotropic" (parasympathetic) components, also comprising sleep, were found to be located in the antero-lateral hypothalamus, while the "ergotropic" (sympathetic) components were found in the posterior, ventromedial hypothalamus and perifornical region (Akert, 1999). Stimulation in the posterior hypothalamus led to intense excitement, sometimes with defence-like performance as if in a state of anxiety or rage. Bilateral lesions in this region induced apathy, adynamic states, and sleep-like behaviour, but not the complete set of characteristics of physiological sleep (Akert, 1981). On the other hand, stimulation in the anterior "trophotropic" region of the hypothalamus resulted in fall of blood pressure, slowing of respiration and pupillary constriction. Furthermore, hunger, thirst, defecation, or micturition could also be provoked by stimulation of anterior sites of the hypothalamus

(Akert 1981). In 1949 Hess was awarded the Nobel Prize "for the discovery of the functional organization of diencephalon as a coordinating centre of visceral function".

Hess's physiological concept of sleep has laid the foundations and provided the basis for a sleep research tradition in Switzerland, first carried on by his immediate disciples Konrad Akert (later as first chairman of the Brain Research Institute Zürich), Werner P. Koella, Marcel Monnier (both later at the University of Basel), and by his son Rudolf Max as clinical electroencephalographer at the University of Zürich carrying out night recordings in normal and abnormal human sleep in the 1960s. In 1976 the psychologist Inge Strauch obtained a chair in Zürich to establish a human sleep laboratory to pursue her research on dreams. Around the same time Alexander Borbély launched a sleep laboratory which developed into a very fruitful sleep research group at the Pharmacological Institute of the University of Zürich. Borbély is best known for the influential two process model of sleep regulation he presented in 1982. In Basel the sleep tradition was importantly continued by the chronobiologist Anna Wirz-Justice and her research group. Jean-Michel Gaillard established in the 1970s a clinical polysomnographic laboratory at the Psychiatric University Department of Geneva, as did Hess's grandson Christian W. in the 1980s at the Neurological University Department of Bern. In this latter laboratory, which expanded to an interdisciplinary unit together with the pneumologists, Claudio Bassetti performed his seminal studies in thalamic stroke patients before moving to Zürich, where he launched a clinical and experimental sleep research group in 2001.

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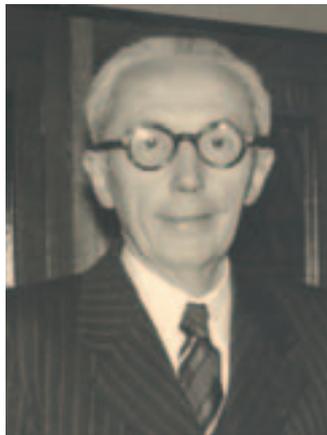
## Frédéric Bremer 1892 – 1982: His ‘Cerveau Isolé’ and ‘Encéphale Isolé’ Preparations

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In 1919, after brilliant medical studies at the Université Libre de Bruxelles, Frédéric Bremer (Fig. 1) started his training in neurology at the Hospital de la Salpêtrière in Paris in the department of Pierre Marie. Being appointed a fellow of the American Educational Foundation, he spent a year at Harvard University in the Laboratory of H. Cushing and had the opportunity to visit the laboratories of W. B. Cannon and A. Forbes. Before getting back to Belgium, he spent some time in the laboratory of Sir Charles Sherrington at Oxford. Being a fellow from the Université Libre de Bruxelles since 1924, Frédéric Bremer was a popular teacher and became Professor of General Pathology in 1934.

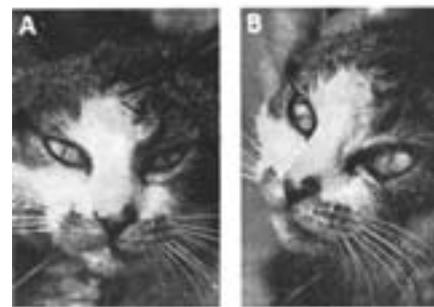
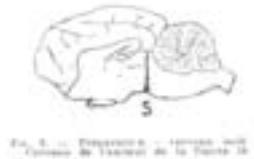


**Figure 1.** Frédéric Bremer (reprinted with permission from "Archives et Bibliothèques de l'Université Libre de Bruxelles").

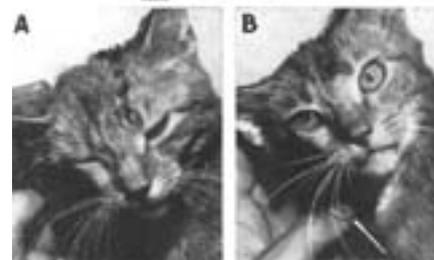
He published his first scientific paper with P. Bailey from the laboratory of H. Cushing, concerning the cause of diabetes insipidus. In this paper they showed that a small lesion of the hypothalamus could induce diabetes insipidus. Interestingly, these lesions were also shown to induce sleepiness and adiposity. The investigation of the physiology of the cerebellum and of the control of muscular tone was among the first topics of research of Frédéric Bremer at the Université Libre de Bruxelles. Could these experiments have led him to sleep research? This is possible but not entirely clear. The findings of von Economo in 1929 on the existence of sleep centres near the hypothalamus could also have influenced him to pursue a thread in sleep research (Kerkhofs and Lavie, 2000).

The main findings of Frédéric Bremer are related to his famous ‘Cerveau isolé’ and ‘Encéphale isolé’ preparations in the cat, performed in 1935. In the first experiment he performed a mesencephalic transection behind the nuclei of the third nerve with surprising results. Indeed, this transection induced a state identical to natural sleep which persisted indefinitely. The EEG

was characterized by a regular rhythm of 6 – 10 Hz and high synchronous potential waves. Bremer attributed this finding of the ‘cerveau isolé’ to the deafferentation of the telencephalon, which deprived the brain from the flow of sensory impulses (Fig. 2). In order to test this hypothesis, he performed a control experiment in which he made the transection at a lower level, just above the junction of the brainstem with the spinal cord, in which more sensory pathways were left intact. Bremer named this preparation the ‘encéphale isolé’ (Fig. 3). In contrast to the ‘cerveau isolé’ preparation, the ‘encéphale isolé’ cat showed an alternation between sleep and wakefulness similar to a normal cat (Bremer, 1935, 1937).



**Figure 2.** The ‘cerveau isolé’ (reprinted from the *Bull. Acad. R. Med. Belg.*, 1937, 4: 68-86, with permission).



**Figure 3.** The ‘encéphale isolé’ (reprinted from the *Bull. Acad. R. Med. Belg.*, 1937, 4: 68-86, with permission).

F. Bremer concluded that sleep in mammals resulted from a decrease in cortical tone which is maintained by the flux of sensory information to the brain. Thus, his view on sleep as a passive condition was in line with the very old conceptions of sleep. A new interpretation of Bremer's findings came from the discovery of the reticular formation by Moruzzi and Magoun in 1949. Bremer himself immediately understood the importance of this discovery and started a series of experiments with the ‘encéphale

# The Founders of European Sleep Research and Sleep Medicine

isolé' preparation in order to investigate the relations between the cortex and the reticular formation. He subsequently suggested that sleep could be explained by antagonistic influences of the arousal and hypnogenic systems.

Bremer made also pioneering experiments related to the impact of light on the hypnogenic structure, always using his 'encéphale isolé' preparation (Bremer 1976, 1979).

The views of Frédéric Bremer on sleep regulation evolved in parallel of all scientific progresses such as the discovery of REM sleep, the influence of neurotransmitters on sleep and sleep stages. His insights were recapitulated in several reviews and his work was quoted by many researchers after him. Frédéric Bremer, being a bright thinker and a citizen of the world, made seminal contributions in the exploration of the mysteries of sleep.

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## Giuseppe Moruzzi: An European School of Neurophysiology in the University of Pisa

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The renown Italian scientist Giuseppe Moruzzi (Fig. 1) marked the extraordinary advancement of neurophysiology in the last century. The international scientific community, the International Society for the History of Neurosciences and the University of Pisa recently commemorated the centenary of his birth (see Batini, 2011)

Moruzzi started his training in science with A. Pensa, a pupil of C. Golgi, then with M. Camis, a pupil of C. Sherrington. He was introduced to neurophysiology in the tradition of the classic physiology of L. Luciani and of C. Sherrington. With F. Bremer, in Brussels, he acquired the new methods of electroencephalography (EEG) and of Bremer's *cerveau isolé* and *encephale isolé* sleep-wake preparations. The following year he completed his training in electrophysiology at Cambridge with E. D. Adrian studying single unit recording in the central nervous system. All together, Moruzzi received an exquisite European training in neurophysiology. Not only did he learn classical and new research methods, but he was also confronted by strong scientific personalities from whom he acquired clarity of thinking, imagination, creativity and, most important, "*saper vedere*".



**Figure 1.** Portrait of Giuseppe Moruzzi (Carmagnola, 1910 – Pisa 1986), taken at the first Nobel Symposium organized by R. Granit in Stockholm, June 1956. (Photo courtesy of the family).

**Research into sleep-wake cycles (see Moruzzi, 1972)** was his major scientific interest. In Italy during the difficult years of the war, he published his first article on sleep mechanisms in the pigeon "*scerebrato*". Three years later, invited by the University of Chicago, he worked with H.W. Magoun who recently had discovered the descending facilitatory and inhibitory functions of the reticular formation, the large brain stem structure which, at the time, was essentially neglected by neurophysiologists. Moruzzi had observed cerebellar inhibition of the motor cortex neurons, leading Moruzzi and Magoun, together, to the idea that the cerebellar motor inhibition could be mediated by the reticular formation. As a first methodological step, they assessed the effect of reticular stimulation on cortical EEG activity, and had by "chance" (as stated by Magoun) discovered "the presence in the brain of a system of ascending reticular relay, whose direct stimulation activates or desynchronizes the EEG", which they called the **activating reticular system** (ARS). The passive sleep theory (see Moruzzi 1964) advocated

by Bremer (i.e. wakefulness is maintained by sensory afferents, and sleep by the absence of wakefulness) was in keeping with contemporary knowledge that only the specific sensory pathways reach the cortex. For Moruzzi and Magoun the theory of deafferentation could now be shifted to the ARS, provided that the specific sensory systems could impinge upon the ARS. However, they hesitated in considering that sleep mechanisms were only passive since, as was shown in a companion paper, Magoun and coworkers could not induce sleep by sectioning the specific sensory pathways. Needless to say, this finding with the ARS in relation to sleep precipitated a considerable number of neurophysiological studies, further promoted by Moruzzi, and leading to a greater understanding of sleep-wakefulness mechanisms. The ARS functions were also investigated by psychologists and clinicians particularly interested in habituation, perception, consciousness, anesthesia, coma or epilepsy.

A few years later, in 1957, a symposium was held in Parma involving experimentalist and clinicians, whereby a general agreement was reached over two functions of the ARS: a tonic activity maintaining wakefulness, facilitated by converging sensory inputs, and a phasic activity evoking the arousal reaction. The symposium discussed a second important advancement in sleep research, published by Moruzzi and his school only few days before, and stated by F. Visintini to be "*una delle più importanti novità del nostro convegno*". In trying to assess both the extent of the ARS responsible for wakefulness and the effectiveness of sensory inputs to the ARS, it was found that a pre-trigeminal midpontine brain stem transection produced (again unexpectedly) a persistent pattern of wakefulness. This led to the idea of sleep as an active process arising in the posterior part of the pontine reticular formation. This idea, previously defended by the eminent scientists, C. von Economo, I. P. Pavlov and W. R. Hess, has been substantiated further by data collected over the following years, and mostly endorsed by Moruzzi (see Moruzzi, 1972). Moreover, and as predicted by Visintini, the discovery has also helped clinicians understand the 'locked-in syndrome' (see Berlucchi in Batini, 2011).

Having now consolidated the theory of sleep as an active process, Moruzzi turned his interest toward the unsolved problem of the need for sleep, and elaborated the theory of **sleep as an instinct** (Moruzzi 1969). In this last period of his scientific activity his reasoning was mostly theoretical, but backed by some experimental findings and, here, we would like to mention two innovative concepts. First, to explain sleep as restoration he introduced the idea of a slow plastic process at the synaptic junctions: "we sleep merely (or mainly) in order to permit recovery of those synapses which are able to learn". This hypothesis has been a precursor for the numerous recent studies on synaptic plasticity that are supposed to explain memory and learning. Second, he introduced the notion that instinctive behaviour does not necessarily need motor activities, as it can also be a resting state. The work with his associated (see Musumeci *et al.* in Batini, 2011), traced the relationship between reticular activity and instinctive behaviours. Finally, to synthesize his work on sleep-wake research, from the discovery of the ARS to sleep as an instinct, he developed a **unified theory of reticular function**, where the latter's degree of activation or deactivation permits the expression of the various behaviours, from those requiring higher levels of reticular activity for consciousness, down to drowsiness and sleep, and finally to coma with absence of consciousness. Figure 2 illustrates this theory. We should add, that earlier in his investigations, Moruzzi was involved in the controversial debate on the role of the thalamus-hypothalamus

# The Founders of European Sleep Research and Sleep Medicine

in sleep-wake regulation. His position (Moruzzi, 1972) was that the brain-stem reticular system, with its complex and skilled activation-deactivation ability, is the principal regulator.

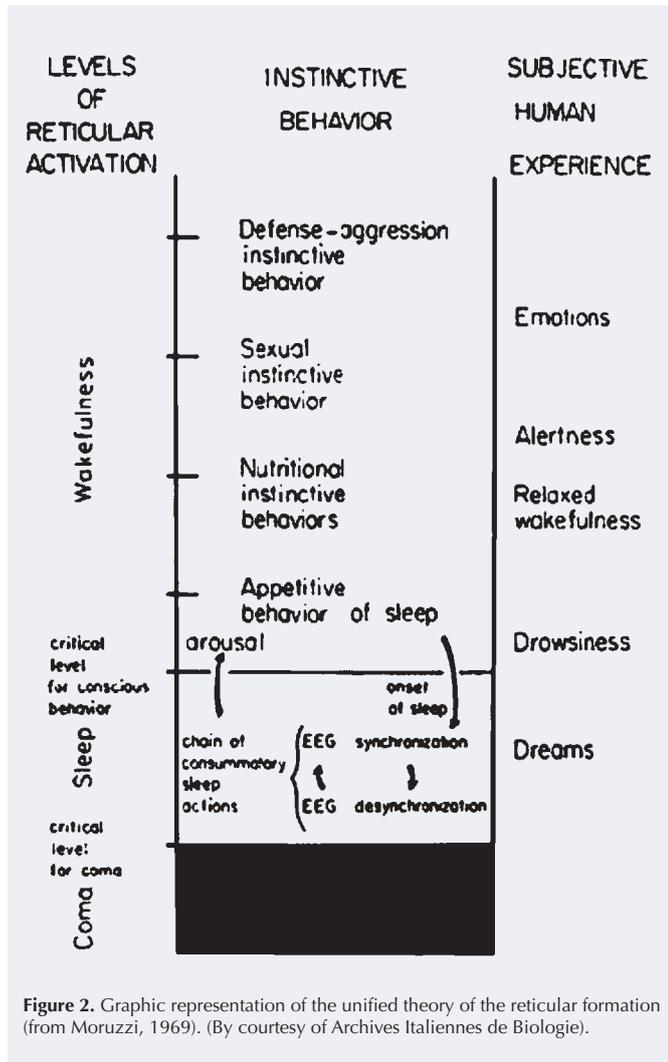


Figure 2. Graphic representation of the unified theory of the reticular formation (from Moruzzi, 1969). (By courtesy of Archives Italiennes de Biologie).

**The European dimension of Moruzzi** and his highly ranked school in Italy is reflected by several landmarks. The interest raised by the discovery of the ARS met the post-war climate, to build a new science in a new Europe. Invited to remain in USA, at that time the leading scientific nation of the western world, he returned to Italy and was appointed to the University of Pisa. As a young Professor of Physiology, his courses (see Ghelarducci in Meulders *et al.*, 2010) were always logically constructed and informative (as were his publications) and attracted many Italian students, some of whom became clinicians or emigrated, whilst others continued to work in neurosciences and teach at different Italian Universities. Subsequently, and in pursuing Moruzzi's teachings, their innovative and rigorous investigations were highly regarded. For example, as with those by G. Berlucchi, that led him to postulate, for the first time, the existence of a hypothalamic clock responsible for the timing and the alternation of sleep-wakefulness (see Bentivoglio in Batini, 2011). Later, when Moruzzi became head of the Institute of Physiology, he attracted many foreign scientists, particularly from eastern and western European countries; all being interested in following his approach to sleep-wake problems. B. Zernicki, from Poland, the principal investigator behind the understanding of cognitive

activities associated with the awake midpontine preparation (see Berlucchi in Batini 2011) has remarked, "he was my teacher". Moruzzi also actively promoted European meetings on Neurosciences, namely, the 1958 symposium held in Moscow, that enabled scientific communication between western and eastern countries at the time of the cold war. He organized the first IBRO meeting in Pisa, on "Brain mechanisms", attended by international researchers (24 out of the 36 were European). Finally, the European dimension of Moruzzi remained quite apparent after his retirement and exemplified by the decision of the European Neuroscience Association Council to instigate a "Moruzzi Lecture".

**Moruzzi was a humanist.** His winsome personality attracted the attention of scientists, clinicians and students, as well as writers and journalists. For a detailed description of "il Professore" we refer the reader to the recent collection of articles on "Portraits of a scientist" (Meulders *et al.*, 2010). Moruzzi was indeed a man of great quality who firmly believed in justice. His early school education and family shaped his interest very much towards the humanities. This trait was reflected by his approach to integrated physiology that tries to understand the living being as a whole. As his son Paolo Moruzzi said (cf Meulders *et al.*, 2010), "The link he had provided in his spirit between humanistic and scientific culture made possible the opening of an interrelationship which was reinforced by the reading of the great works in both fields, so as to remove the boundaries between science and poetry".

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# The Founders of European Sleep Research and Sleep Medicine

## R. Jung, W. Kuhlo, J. H. Peter and the German School

*Thomas Penzel  
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Universitätsmedizin Berlin, Charitéplatz 1, 10117 Berlin*

Sleep research and medicine has a long tradition in Germany with roots in physiology, neurology, psychiatry, and experimental psychology. The development of electroencephalography (EEG) by Hans Berger, head of the Psychiatric University Clinic in Jena became a cornerstone for the physiological measurement of sleep as polysomnography.

Sleep medicine in Germany became more popular and spread out in several universities with the worldwide recognition of sleep disordered breathing in the 1980s.

In Germany Richard Jung (see Photo 1) and Wolfgang Kuhlo in the Department of Neurology at the University in Freiburg were the first who published in 1965 a case report 'Neurophysiological Studies of Abnormal Night Sleep and the Pickwickian Syndrome' in a patient where they reported on sleep disordered breathing and introduced the treatment of tracheostomy for this particular patient. There was no follow up to this description with a larger group of patients, even if W. Kuhlo reported some years later that he has seen a number of similar patients thereafter.



**Photo 1.** Richard Jung

In the early 1980s a few groups in Germany started to investigate sleep disordered breathing when monitoring patients with EEG and respiration during sleep in parallel. The initial groups were set up in Marburg by J. H. Peter in the department of internal medicine and in Freiburg by Matthys in the department of pneumology. In Freiburg the people who started to set up the sleep laboratory were Jürgen Fischer, Dieter Köhler and Karl-Heinz Rühle. All three moved to other towns in Germany, became head of hospitals and continued with widely recognized sleep centers in their particular hospitals. They continued research in sleep medicine and promoted many activities in this field.

In Marburg Jörg Hermann Peter set up a large interdisciplinary group with many people involved. The very first recording of patients were done in 1981 at night using the heart catheter laboratory and the expertise of Hermann Peter from earlier vigilance investigations achieved in neurophysiology. At that time sleep apnea was regarded as a rare phenomenon. The first people in the sleep lab built up with some support by the head of the department of internal medicine and pneumology, Peter von

Wichert, were Eckhard Fuchs, Ulrich Köhler, Willi Bräutigam, Thomas Podszus, Thomas Penzel, Jürgen Mayer and Heinrich Becker. The sleep lab got some rooms for offices and daytime investigations and was forced to do ambulatory studies initially because there were no dedicated beds for the sleep center. For the portable sleep studies the 'Marburger Koffer', a four channel recording unit with ECG, oxygen partial pressure, and two belts of respiratory inductive plethysmography was created. The first digital sleep recordings were implemented in 1983 with an Apple IIe computer recording already 16 channels in a temporarily available recording room. Only in 1984 sleep lab rooms were devoted for night and daytime use. Soon after that Hartmut Schneider, Ludger Grote, Ricardo Stoohs, Klaus Ehlenz, Wulf Pankow, Regina Conradt, Werner Cassel, Thomas Ploch, Jörg Heitmann joined the group. Walter Hochban and Friedhart Raschke worked at different departments in the medical faculty but closely together with the sleep lab. Many of these moved to different places in Germany and worldwide and continued with sleep research at their new places.



**Photo 2.** The third Marburg Symposium was dedicated to Cardiocirculatory function during sleep. It took place from 31 August to 2 September 1994. This photo shows the organizers from left to right: Thomas Podszus, Jörg Hermann Peter, Peter von Wichert, Thomas Penzel.

In 1985 one of the first portable digital sleep apnea recorders was created in Marburg. This was the MESAM with a recording of heart rate and snoring only and was further developed to the MESAM IV recording heart rate, snoring, oxygen saturation and body position. With that device reimbursement for portable sleep studies started at an early point of time in Germany. The MESAM developed further to the Polymesam and the Micromesam (today known as Apnealink).

Hermann Peter had worked in Psychology, Medical Statistics and Physiology before. In Physiology he studied vigilance problems in monotonous situations such as train and car driving during the night and cardiac consequences of the stress fighting against sleepiness. With this knowledge he was well prepared to study sleep disordered breathing. From early on he linked technology, physiology, neurology and pneumology to this new field of research. With his efforts the traditional, neurological and psychiatric sleep research field existing in Germany with groups in Munich with Hartmut Schulz, Eckart Rütter and in Mannheim (which moved to Freiburg after a few years) Mathias Berger, Dieter Riemann, and Treysa with Meier-Ewert and Geert Mayer came together to hold joint meetings.

In the very beginning the investigations on respiratory issues during sleep were not regarded as core sleep disorders in

# The Founders of European Sleep Research and Sleep Medicine

Germany. As such the first meetings were subgroup meetings of the German Pneumology Society. A group of researcher devoted to sleep disordered breathing 'Working Group on nocturnal circulatory and respiratory disorders (AGNAK) met in Marburg in 1984. With that meeting a series of conferences of this particular subgroup continued and still takes place every year. The first joint meeting with the traditional sleep centers and the pneumological sleep centers was labelled AKS (Arbeitsgemeinschaft Klinischer Schlafzentren) and was an assembly of delegates from 15 clinically working sleep researchers in 1987. The aim of this meeting and the succeeding conferences was to join research and clinical efforts in this small but growing field of sleep medicine. Out of this interdisciplinary initiative the German Sleep Society (DGSM) was found in 1992.

In addition the work group meeting in Marburg in 1984 was perceived as a very stimulating gathering and triggered a series of international conferences on various aspects of sleep disordered breathing in Marburg in 1986, 1990, 1994 (see Photo 2). With these international cutting edge symposia the group in Marburg received international recognition. Many well-known international researchers were invited to attend these symposia in Marburg. New ideas spread through these symposia in the field of sleep and breathing in Germany, Europe and worldwide.

In 1984 the ESRS congress was held in Munich by E. Rütger and H. Schulz. In 1997 the World Congress on Sleep Apnea was held in Marburg by J. H. Peter (see Photo 3) and in 1999 the World Federation of Sleep Research Societies had its third congress in Dresden, organized by H. Schulz.



**Photo 3.** The World Congress for Sleep Apnea took place in Marburg Germany from 17 to 20 September 1997. This major international event attracted about 1000 participants to Marburg.

A sleep lab accreditation was started in Germany in 1992 by the DGSM to show quality of sleep services. In 1997 a certification of sleep physicians, scientists and technicians by the German Sleep Society was initiated. A curriculum was developed and courses were started to teach all aspects of sleep physiology and sleep medicine. The courses initially consisted of six one week modules and were compressed later to four weeks. Educational material was compiled for these courses and for the certification examinations. In 2003 this certification was finally adopted by the chamber of physicians with the creation of a formal subspecialty 'sleep medicine' to which physicians with a completed speciality in pneumology, internal medicine, neurology, psychiatry, ENT medicine, and pediatrics are eligible. The German Sleep Society has its own journal 'Somnologie' since 1997, has more than 2200 members and runs annual congresses with an attendance of 2000 participants. The German Sleep Society remains to be

truly interdisciplinary and is well linked to other German medical societies based on the developments described.

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# The Founders of European Sleep Research and Sleep Medicine

## Elio Lugaresi and the Italian School

Fabio Cirignotta  
University of Bologna, Italy

In the late 1960s, during a period spent in Henry Gastaut's laboratory in Marseilles, Elio Lugaresi saw the first nocturnal polysomnographic recordings of patients with Pickwickian syndrome. It was then that he first grasped that a new frontier in medicine was about to unfold. On his return to Bologna, Lugaresi set up a research team at the Neurology Clinic with the help of Giorgio Coccagna, and in the time span of a few years laid the foundations for the development of sleep medicine worldwide. The Italian sleep research was burgeoning in the wake of the fame achieved by the Pisa school of physiology led by Giuseppe Moruzzi. Together with Horace Magoun, Moruzzi had published his historical experiments on the brain stem reticular formation in 1949 (Moruzzi and Magoun, 1949) and with his pupil Ottavio Pompeiano subsequently went on to pursue research into motor control during sleep. Bologna proved a propitious location for sleep research. Lugaresi's work benefited from ongoing exchange with the physiology school run by Pier Luigi Parmeggiani which with Carlo Franzini was making headway with experimental studies on heat regulation during sleep, and with the psychology school where Marino Bosinelli was undertaking pioneering research into the analysis of cognitive processes during sleep, subsequently continued by Carlo Cipolli.

Lugaresi's group was the first to document the major fluctuations in pulmonary and systemic arterial pressure during obstructive apnoeas and to highlight the close physiopathogenetic connections between snoring and obstructive apnoeas. The international congress held in Rimini in 1972, attended by world experts on breathing disorders during sleep, and the congress proceedings published in the French journal *Bulletin de Physiopathologie Respiratoire* marked a major milestone in clinical sleep research (Lugaresi *et al.*, 1972). This period also saw the first studies on restless legs syndrome and periodic limb movements at the Neurology Institute, followed by research spanning the whole clinical field of sleep disorders.



**Photo 1.** Elio Lugaresi, Fabio Cirignotta, Magda Mantovani and Giorgio Coccagna (1976).

One of the most promising fields of research proved to be the epidemiological studies on insomnia, parasomnia and snoring culminating in an international workshop held in Milano

Marittima in 1982. On this occasion leading experts in the new field of sleep medicine presented their findings subsequently published in a seminal book on the epidemiology and natural history of sleep disorders (Guilleminault and Lugaresi, 1983).

Another field investigated by the Bologna group was that of nocturnal seizures with the identification of nocturnal paroxysmal dystonia and the subsequent nosographic classification of nocturnal frontal lobe epilepsy. Lastly, and this was probably the most exciting finding, Lugaresi and his co-workers, first his pupil Pasquale Montagna, discovered a new prion disease, the "Fatal Familial Insomnia", characterized by loss of sleep associated with motor and autonomic activation, due to a degeneration of thalamo-limbic structures (Lugaresi *et al.*, 1986). The discovery of this novel disease proved an important source of valuable information on the pathophysiology of sleep.



**Photo 2.** Elio Lugaresi and Pasquale Montagna.

Lugaresi had opened a new frontier to clinicians and was soon followed by other Italian neurology schools, namely in Milan with Salvatore Smirne who embarked on research into the pathophysiology of obstructive apnoeas and with Luigi Ferini-Strambi went on to set up a world famous research pole on sleep at the San Raffaele Institute. Other neurological groups included the Pisa school with Muratorio and Murri who were the first to analyse sleep disorders in neurological diseases, the Genoa school with Rosadini and Ferrillo who applied spectral analysis of sleep to clinical questions, and the Parma group with Terzano and Parrino whose identification of the cyclic alternating pattern (CAP) made a key contribution to the knowledge of sleep microstructure (Terzano *et al.*, 1985); the south of Italy was represented by the groups of Di Perri in Messina and Puca in Bari. Among the pneumologists who shared Lugaresi's intuitive grasp of the importance of clinical sleep research was Giovanni Bonsignore who set up a research pole in his respiratory pathophysiology laboratory of the National Research Council in Palermo in the 1970s. This pole played an important role in promoting sleep research among pulmonologists and led to the development of many centres of excellence in the study of breathing disorders during sleep all over Italy.

The development of clinical studies on sleep disorders was flanked by ongoing basic research. In addition to the groups in Bologna, Mario Bertini's school in Rome focused on experimental studies on dreaming, Piero Salzarulo and Iginio Fagioli made key contributions to our understanding of sleep ontogenesis, and Mauro Mancia's group in Milan renowned for their research on thalamo-cortical activity and the relations between sleep and the immune system.

The rest of the story is recent history. The teachings of early pioneers in sleep medicine have inspired a legion of sleep researchers who have maintained the high standards of a great scientific tradition. The list is long, but I would like to cite just some of the fields in which Italian research continues to be at the forefront. Studies on frequency oscillations of the corticothalamic circuits, cortical excitability, and "local sleep" have opened new horizons for

# The Founders of European Sleep Research and Sleep Medicine

basic and clinical research. Likewise, quantitative analysis of the cyclic alternating pattern (CAP) and the spatial distribution of A1 "slow arousals" have disclosed interesting correlations between CAP periodism and frontal cognitive processes. Major results have also been obtained in studies on sleep homeostasis and clinical psychophysiology, and Italian researchers belong to leading international working groups on restless legs syndrome, narcolepsy, nocturnal frontal lobe epilepsy, the autonomic system during sleep and sleep-related breathing disorders.

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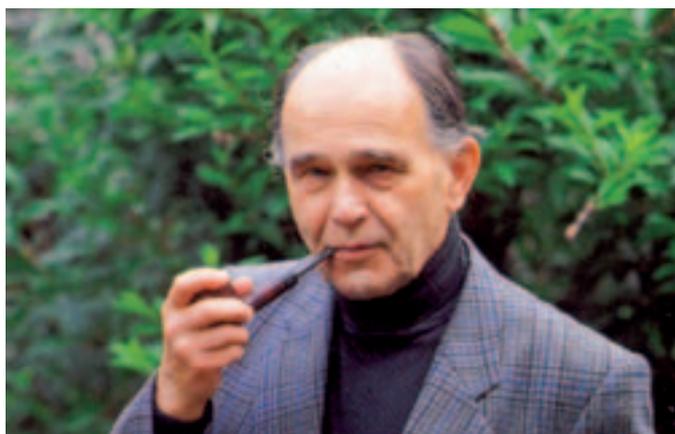
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# 40 Years ESRS: A Historical Photo Collection



Werner P. Koella (13.04.1917 – 13.01.2008)



Michel Jouvet



Adrian Morrison



Pier Luigi Parmeggiani and Michel Jouvet.  
Background: Olga Petre-Quadens, Gerald Vogel, Allan Hobson (Tbilisi 1986)  
Conference Neurobiology of Sleep-Wakefulness Cycle (T. Oniani, organizer)



Pisa Sleep Award to Michel Jouvet  
Alexander Borbély, Luigi Murri, Michel Jouvet,  
Ottavio Pompeiano, Piero Salzarulo



David Parkes, Anthony Nicholson

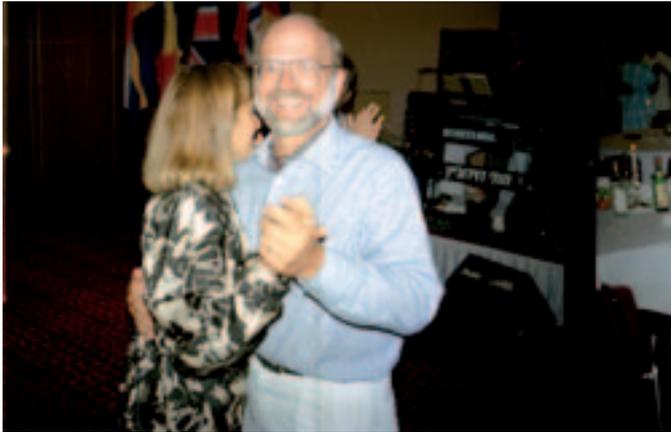


Ken Hume, Jim Horne, Wilse B. Webb (Mexico, 1980)



Lena and Peretz Lavie, back: Markku Partinen (Jerusalem 1988)

# 40 Years ESRS: A Historical Photo Collection



Roger Broughton dancing with Tarja Porkka-Heiskanen (Jerusalem 1988)



Shojiro Inoué, Dag Stenberg (9th ESRS Congress, Jerusalem 1988)



Alex Borbély, Teresa Paiva (Jerusalem 1988)



Dietrich Lehmann, Jean-Michel Gaillard (Jerusalem 1988)



Daniel Kurtz, Hartmut Schulz (Jerusalem 1988)



Tarja Porkka-Heiskanen, Dag Stenberg, Maria Pompeiano, Chiara Cirelli (12th ESRS Congress, Florence 1994)



Ferenc Obál Jr., Damien Davenne, James Krueger



Igino Fagioli (1953 – 2003)



Piero Salzarulo (Eurosleap '94 Firenze)



ESRS Board 1994. Axel Steiger, Irene Tobler, Alain Muzet, Torbjörn Åkerstedt



Anna Wirz-Justice, Torbjörn Åkerstedt, Irene Tobler, Alexander Borbély, 1994



Rosa Peraíta-Adrados, Secretary of the 14th ESRS Congress, Madrid 1998



Antonio Vela-Bueno, President of the 14th ESRS Congress Madrid 1998

# 40 Years ESRS: A Historical Photo Collection



Myriam Kerkhofs, Odile Benoit, Paul Linkowski, Erik Sou  tre. 8<sup>th</sup> ESRS congress, Szeged 1986



Paul Linkowski, Anna Wirz-Justice (8<sup>th</sup> ESRS Congress, Szeged 1986)



Villa di Monte. Poster session in the Tusksany pinewoods, 1983 (organized by Anna Wirz-Justice). Mathias Berger, J  rgen Zulle, Rudi van den Hoofdakker, Hartmut Schulz, Chris Gillin, Simon Elsenga, Daniel Kripke, Robert McCarley



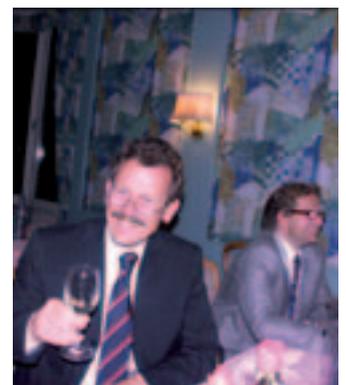
Villa di Monte. Poster session in the Tusksany pinewoods, 1983. Rudi van den Hoofdakker, Hartmut Schulz, Chris Gillin. At the poster: J  rgen Zulle, Simon Elsenga.



Thomas Pollm  cher, Hartmut Schulz (First ESRS Training Course, Munich, 2003)



J  rgen Fischer, 2004



Geert Mayer, Ludger Grote, 2004



Thomas Pollm  cher, Claudio Bassetti, Derk-Jan Dijk (18<sup>th</sup> ESRS Congress, Innsbruck 2006)



Roberto Amici, Philippe Peigneux



Birgit H  gl, Diego Garcia-Borreguero, Poul Jennum (18<sup>th</sup> ESRS Congress, Innsbruck 2006)



Birgit H  gl, Thorarinn Gislason (18<sup>th</sup> ESRS Congress, Innsbruck 2006)

# 40 Years ESRS: A Historical Photo Collection



Claudio Bassetti talking with Colin Espie (19<sup>th</sup> ESRS Congress, Glasgow 2008)

Workshop on polyphasic and ultrashort sleep (Gargonza, 1988) (Paul Naitoh, Peretz Lavie, Robert G. Angus, Charles Czeisler, Michel Billiard, Menno Gerkema, Wilse B. Webb, Claudio Stampi (organizer), Scott Campbell, (unknown person), Pier Luigi Parmeggiani, Hartmut Schulz, David Dinges, Roger Broughton)



The referees. Football match, 20<sup>th</sup> ESRS Congress, Lisbon 2010



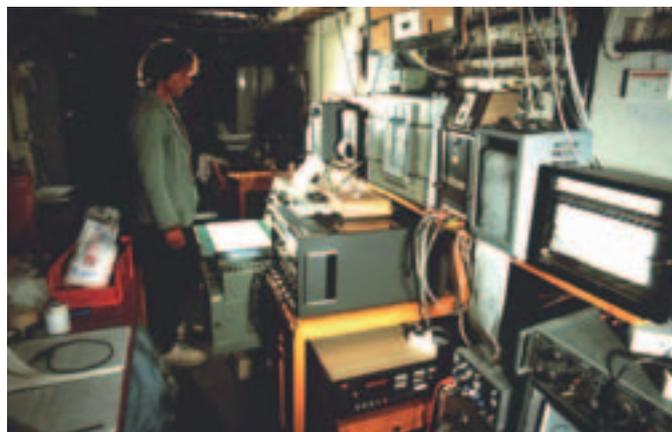
ESRS-EU-Marie-Curie Football Team, 20<sup>th</sup> ESRS Congress, Lisbon 2010



Ultradian rhythms workshop, Seewiesen, 1984 (Post congress meeting, 7<sup>th</sup> ESRS congress)  
 First row: D. Kripke, A. Borbély, E. Knobil, R. Lydic, H. A. Baghdoyan, R. W. McCarley, R. Broughton, F. Kimura, S. Honma, C. Gordon, S. Inoué.  
 Second row: M. Gerkema, K. Stephan, G. Dirlich, M. A. Corner, S. Daan, I. Tobler, H. Schulz (organizer), S. Honma, C. Pollak, W. Ehrenstein  
 Third row: P. Lavie, T. Kobayashi, J. Aschoff, S. Campbell, M. B. Serman, J. Zulley, C. Wildgruber, P. Naitoh, D. Beersma



Scott Campbell, W. R. Hess prize winner from 1986 (together with subject for PSG recording)



Jürgen Zulley recording sleep of a 'freerunning' subject (Andechs, bunker)



Serge Daan and Gerard Groos, sketch of the 2-process model



Alex Borbély lecturing on the 2-process model, ca. 1982

# 40 Years ESRS: A Historical Photo Collection



Sleep models meeting, Zurich 1991  
Paul Franken, Bo Gao, Anna Wirz-Justice, Domien Beersma, Daniel Brunner, Peter Achermann, Andrew Belyavin, Roger Broughton, Peretz Lavie, Irene Tobler, Bob McCarley, Beth Klerman, Alex Borbély, Derk-Jan Dijk, Jürgen Zülley, Janet Mullington, Mitsuyuki Nakao, Marika Lancel, Jim Horne, Steve Massaquoi, (unknown woman), (unknown person), Christian Cajochen, Beat Geering, Dick Kronauer, Serge Daan, (unknown person), Daniel Aeschbach, Charles Czeisler, (unknown person)



2<sup>nd</sup> ESRS Training Course, Ingolstadt 2004. Andreas Schuld lecturing.



2<sup>nd</sup> ESRS Training Course, Ingolstadt 2004. Antonio Vela-Bueno singing.



ESRS EU Marie Curie Program, Participants 2007



ESRS EU Marie Curie Program, 2009, lecture hall.



ESRS EU Marie Curie Program, Zurich 2008.  
The teachers: Myriam Kerkhofs, Debra Skene, Irene Tobler, Peter Achermann



ESRS EU Marie Curie Program, 2009, round of teachers.

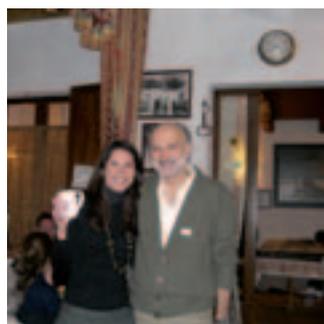
## ESRS EU Marie Curie Program Cup Winners



Cup winner 2007



Roberto Amici with cup winner 2009



Roberto Amici with cup winner 2010



ESRS EU Marie Curie Program. The team behind: Rozi Andretic-Waldowski, Maria Wiechmann, Debra Skene

# 40 Years ESRS: A Historical Photo Collection



ESRS Marie Curie Program 2007 – 2010. Final symposium, Kloster Seeon, 2010



Thomas Pollmächer, Claudio Bassetti, Dieter Riemann, ESRS-EU Marie Curie Program 2010



Maria Wiechmann at ESRS booth, Lisbon 2010



Tarja Porkka-Heiskanen, Dancing Queen, Seeon, 2010



Helen Driver and Derk-Jan Dijk (9<sup>th</sup> ESRS Congress, Jerusalem 1988)



Lab tour in Dag Stenberg's sleep laboratory at the Helsinki University during the 11<sup>th</sup> ESRS Congress, Helsinki 1992. Dag Stenberg (middle with glass). To the right : Anton Coenen, Jidong Fang, Peter Alfvöldi and Zoltan Lekes. To the left of Dag Stenberg: Levente Kapas, Ferenc Obál and a unknown person. The three people from back: Joëlle Adrien, Christine Dugovic and a male unknown person.

# The National Sleep Societies

## AUSTRIA



### Österreichische Gesellschaft für Schlafmedizin / Austrian Sleep Research Association (ÖGSM / ASRA)



Current President: Dr. Wolfgang Mallin

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<b>Foundation year</b>	1991
<b>Webpage</b>	<a href="http://www.schlafmedizin.at">www.schlafmedizin.at</a>
<b>Number of members</b>	200 members (Dec. 2011)
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	physicians: 164 (neurology, psychiatry, pulmonology, internal medicine, ENT, pediatrics, dentistry); researchers: 7; nurses: 7; technicians: 17; others: 5
<b>Historical perspective of the society</b>	<p>The ASRA was founded following an international meeting in Nice / France in October 1991. The first national meeting took place in 1992 with invited speakers from Germany (J. H. Peter, T. Podszus). Since then annual meetings have taken place across the country. The highlight was to host the ESRS meeting 2006 in Innsbruck.</p> <p>Since the foundation there have been 7 presidents (named in chronological order): Zeitlhofer J., 1991 – 1995 Bolitschek J., 1996 – 1998 Saletu B., 1998 – 2002 Popovic R., 2002 – 2006 Högl B., 2006 – 2010 Kerbl R., 2010 – 2012 Mallin W. 2012 –</p>
<b>Important sleep physicians / researchers in the history of the NSS</b>	(in alphabetical order) Univ. Prof. Dr. Birgit HÖGL (Innsbruck), Univ. Prof. Dr. Bernd SALETU (Vienna), Univ. Prof. DDr. Josef ZEITLHOFER (Vienna)
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	Currently there are 31 ASRA-certified sleep labs in Austria <a href="http://www.schlafmedizin.at/deutsch/slabormap.html">http://www.schlafmedizin.at/deutsch/slabormap.html</a>
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	3 (one at the Medical University of Innsbruck and two at the Medical University of Vienna)
<b>Accreditation / Certification procedure</b>	According to the guidelines of the ESRS and the DGSM with slight national modifications
<b>Educational programs</b>	Education for sleep technicians, nurses and doctors during the annual scientific meetings
<b>Present activities, working groups, task forces</b>	Working group of the ASRA for specialisation in sleep medicine since 2008. Activity of members of the ASRA in international societies and working groups of the ESRS / ANSS, WASM, ERS (HERMES Sleep), IRLSSG, IRBDG, COST B 26 and others.

# The National Sleep Societies

## BELGIUM



### Belgian Association for Sleep research and Sleep medicine B.A.S.S.



Current President: Prof. Dr. Robert Poirrier

**Foundation year** 1982

**Webpage** [www.belsleep.org](http://www.belsleep.org)

**Number of members** 351

**Composition of members (degree, specialties, subspecialties, etc.)** Pneumologists 32,1%, Neurologists 10,8%, Psychiatrists 4,6%, ENT surgeons 4,3%, Pediatricians 2,3%, Family practitioners 3,4%, Psychologists 6,8%, Dentistry 2,3%, Physiotherapists 2,0%, Nurses 10,3%, Technologists 6,0%, Biologists 1,1%, Others 14,0%

#### Historical perspective of the society

The BASS is the oldest member of the great family of National Sleep Societies in Europe and was founded in 1982 by Prof Georges Franck (neurologist, Liège), Prof Roger Matthys (psychiatrist, Antwerp), Prof Julien Mendlewicz (psychiatrist, Brussels) and Prof Jean Wilmotte (psychiatrist, Charleroi). The BASS adopted English as the official society language right from the start. The society has a past that is hallmarked with exciting activities and remarkable achievements. Since its foundation the association has been organising scientific meetings twice a year. Some of these meetings were organised jointly with other Belgian scientific societies and foreign sleep societies, involving colleagues from the Netherlands and Luxemburg. One major event in the history of BASS was the organisation in Brussels in 1996 of the 13<sup>th</sup> congress of the European Sleep Research Society: 823 sleep researchers attended the congress from June 16 – 21. BASS has promoted research through the organisation of invitation-only lectures, free communications, and, for the past twelve years, the presentation of the Belgian Sleep Research Award, which is currently named after the late André Kahn. This prize amounts to € 4,000 and is awarded to the winner of the scientific contest at the autumn meeting. At the same time the VAPA Sleep Apnea Research Award (500 €) is offered to the best contribution on sleep disordered breathing and is created by the Flemish association for sleep apnea patients. 'Sleep and society' is another very important point of interest. Since 2001, each year on March 21, BASS sponsors the National Sleep Day to enhance awareness for sleep and its diseases in Belgium. The Belgian Sleep Medicine Course (BSMC) was one of the latest successful projects of the association. This course in English language covers all major aspects of sleep physiology and pathology and is endorsed by most Belgian universities. Since 2007, this course is organised jointly with the Dutch and British Sleep Societies as the International Sleep Medicine Course (ISMC). Participants are offered the chance to test their scientific knowledge in a 'sleep examination', which consists of 50 multiple-choice questions and covers both theoretical and practical aspects of sleep medicine. The number of members is still growing, currently more than 300. In 2007 a jubilee book was published to celebrate its 25<sup>th</sup> birthday.

#### Important sleep physicians / researchers in the history of the NSS

Founding members:  
G. Franck; R. Matthys; J. Mendlewicz; J. Wilmotte

Presidents:  
1982 – 1984: G. Franck  
1984 – 1986: J. Mendlewicz  
1986 – 1992: A. Kahn  
1992 – 1996: J. De Roeck  
1996 – 2000: M. Kerkhofs  
2000 – 2008: D. Pevernagie  
2008 – 2012: R. Poirrier

# The National Sleep Societies

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<b>Number of Sleep Medicine Centers</b> (link to their titles and locations)	72 centres are officially authorised to prescribe CPAP therapy ("CPAP convention centres"). Another 28 centres perform sleep studies without a license to offer CPAP.
<b>Number of Sleep Research Centers</b> (link to their titles and locations)	8 centres of excellence publish regularly in peer-reviewed scientific journals: University of Antwerp (UA-UZA): <a href="http://www.uza.be">www.uza.be</a> Free University of Brussels (ULB): <a href="http://www.ulb.ac.be">www.ulb.ac.be</a> Free University of Brussels (VUB): <a href="http://www.vub.ac.be">www.vub.ac.be</a> University of Ghent (Ug): <a href="http://www.ugent.be">www.ugent.be</a> University of Leuven (KUL Leuven): <a href="http://www.kuleuven.be">www.kuleuven.be</a> University of Liège (Ulg): <a href="http://www.ulg.ac.be">www.ulg.ac.be</a> Université Catholique Louvain (UCL Brussels): <a href="http://www.uclouvain.be">www.uclouvain.be</a> Hôpital André Vésale (Charleroi): <a href="http://www.chu-charleroi.be">www.chu-charleroi.be</a>
<b>Accreditation / Certification procedure</b>	No SMC accreditation procedure; Professionals in sleep medicine receive a certificate of appropriate knowledge when they succeed the ISMC exam Postgraduate inter-university course in French language comes with a certificate
<b>Educational programs</b>	ISMC Sleep course of the Lowlands (Netherlands and Flanders) Postgraduate inter-university course in French language
<b>Present activities, working groups, task forces</b>	The following activities are managed by subcommittees: - Secretariat - Treasury - Accreditation - Education - European Affairs - Sleep & Society - Press & Communication

# The National Sleep Societies

## BULGARIA



### Българско дружество по медицина на съня

### Bulgarian Society of Sleep Medicine



Current President: Dr. Slavcho Slavchev

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<b>Foundation year</b>	2002, officially registered 2008
<b>Webpage</b>	none
<b>Number of members</b>	30
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	Neurologists 25%, Pneumologists 15%, Neurophysiologists 20%, Neuropsychologists 5%, ENT 5%, Psychologists 10%, Cardiologists 10%, Biomedical Engineers 5%, IT specialists 5%. Professors 3, Assoc. Prof. 8, PhD 12, DSci 3, MD 29
<b>Historical perspective of the society</b>	<p>The Bulgarian Society of Sleep Medicine was founded in 2002, but the official registration took place in 2008.</p> <p>First experimental and clinical sleep studies in Bulgaria were performed in early 1960s.</p> <p>Main topics at present: Sleep disordered breathing (SBD) and cognitive impairment, Sleep in neurology; SBD and cardiovascular co-morbidity, Sleep at high altitude, EDS, Drowsy driving. Metabolic disturbances and OSA, Sumo sports and sleep, Insomnia.</p> <p>The aim of the society is to educate and disseminate the knowledge of sleep by organizing courses and seminars.</p>
<b>Important sleep physicians / researchers in the history of the NSS</b>	Alexander Alexiev, Bozhidar Dimitrov, Ivan Stajkov, Milena Nikolova, Milena Milanova, Pencho Kolev, Plamen Kotzev, Petar Petrov, Philip Alexiev, Slavcho Slavchev, Zahari Zahariev
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	University Hospitals: Sofia: St. Naum-1, St. Anna-1, Alexandrovska-1, Military Medical Academy-1, Academy of Science-1, National Sports Academy-1 Plovdiv St. Georgi-2, Varna St. Marina-1 Pleven-1, Russe-1, Burgass-1 Private: Sofia: MANA, Tokuda, Hill Clinic, Plovdiv ENT-1
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	Sofia – St. Naum, Alexandrovska, MANA, Institute of Population & Human Studies at the Bulgarian Academy of Science, Sofia State University, Department of Cognitive Psychology
<b>Accreditation / Certification procedure</b>	In process. A process for accreditation of sleep centers and sleep specialists is in preparation in accordance with the European standards. The “Grandfathering” process is not completed yet.

# The National Sleep Societies

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<b>Educational programs</b>	<p>International: International Federation of Clinical Neurophysiology, 5 days educational course in Sleep Medicine, Sofia 2002 European Neurology 2 days, Educational course in Sleep Medicine, Sofia 2008 Philips/Respironics 2 days, Educational course in Sleep Medicine, Sofia 2010</p> <p>National: Neurological Congress 2006, 2011, Sleep Seminars Cardiological Congress 2007, 2010, Sleep medicine Seminars One day Sleep medicine course in Shumen, 2011 Three months course in neurology with an examination in Sleep medicine 2010, Sofia Three months course in Psychophysiology and Sleep Three months course in Psychology, Sleep and Health</p>
<b>Present activities, working groups, task forces</b>	<p>Drowsy driving and OSA: an initiative for prevention of traffic accidents in cooperation with the Bulgarian Red Cross, National Traffic Police, Bulgarian Auto Union, Sleep and Health Foundation, Dr. Slavcho Slavchev Cognitive impairments and OSA: Prof. B. Dimitrov, P. Petrov Metabolic disturbances and OSA: M. Milanova CBT of insomnia: Assoc. Prof. E. Christova-Slavcheva Public relation and media: Board of the Society</p>
<b>Miscellaneous</b>	<p>At present there is no reimbursement in sleep medicine.</p>

# The National Sleep Societies

## CROATIA



Current President: Prof. Dr. Zoran Dogas

### Hrvatsko somnološko društvo- -Društvo za medicinu spavanja Hrvatskoga liječničkog zbora Croatian Somnological Society-Society for Sleep Medicine of the Croatian Medical Association

<b>Foundation year</b>	1994
<b>Webpage</b>	<a href="http://www.mefst.hr/neuroznanost/hds-dms-hlz">www.mefst.hr/neuroznanost/hds-dms-hlz</a>
<b>Number of members</b>	40
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	Basic biomedicine and health research, neurologists, psychiatrists, ENT surgeons, pulmonologists, psychologists, dental medicine, etc. We also offer associate memberships for students and technicians.
<b>Historical perspective of the society</b>	The first whole-night EEG and polygraph recordings was performed by Prof. Vera Dürrigl in early 1970s in Zagreb, Psychiatric Hospital Vrapce at the Service for EEG and Clinical Psychophysiology. The first Center for Sleep Disorders in Croatia was established by Prof. Vera Dürrigl in 1981 at the Psychiatric Hospital Vrapce in Zagreb. The Croatian Somnological Society was founded in 1994 as a section of the Croatian Medical Association and Prim. Dr. Danilo Hodoba was elected the first president. The first Sleep Laboratory in Southern Croatia was founded in 2001 in Split as a joint project of the University of Split, School of Medicine and University Hospital Split. The founders were Prof. Zoran Dogas, head of the Department of Neuroscience and Prof. Goran Racic, head of the ENT Department. The two major sleep laboratories in Zagreb and Split became Sleep Medicine Centers at the general assembly meeting of the Croatian Somnological Society-Society for Sleep Medicine of the Croatian Medical Association in 2010.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Prof. Vera Dürrigl, the first whole-night EEG and polygraph recordings in early 1970s; established the first Center for Sleep Disorders in Croatia in 1981. Danilo Hodoba, the founder and the first president of the Society; head of the Department for Clinical Psychophysiology, Psychiatric Hospital Vrapce. Pavao Krmpotic, director of the Sleep Medicine Center, Psychiatric Hospital Vrapce. Prof. Goran Racic, co-founder of the Sleep Medicine Center in Split; Head of the ENT Department, University Hospital Split. Prof. Zoran Dogas, co-founder and the director of the Sleep Medicine Center in Split; founder of the basic neuroscience animal lab in respiratory control, head of the Neuroscience Department, University of Split, School of Medicine. Dr. Branko Sever, founder of the Sleep Lab at the Clinic for Pulmology Jordanovac of the University Hospital in Zagreb in 2003. Prof. Dr. Biserka Resic, founder of the pediatric sleep lab at the University Hospital Split. Dr. Vukmir Vlastic, founder of the pediatric sleep lab at the Children's Hospital Srebrnjak in Zagreb.
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	In 2010, first 2 officially accredited Sleep Medicine Centres according to ESRS guidelines: - Sleep Medicine Center, Psychiatric Hospital Vrapce, Zagreb, Croatia - Sleep Medicine Center in Split, University Hospital Split and University of Split, School of Medicine, Split, Croatia ( <a href="http://www.mefst.hr/default.aspx?id=1742">http://www.mefst.hr/default.aspx?id=1742</a> )
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	Department of Neuroscience, Laboratory for Basic Neuroscience and Laboratory for Clinical Neuroscience with Sleep Medicine Center, University of Split, School of Medicine, Split, Croatia <a href="http://www.mefst.hr/default.aspx?id=594">http://www.mefst.hr/default.aspx?id=594</a>

# The National Sleep Societies

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**Accreditation /  
Certification procedure**

ACC procedure started in 2010 with 2 accredited full SMCs (in Zagreb and Split) according to ESRS guidelines as published in 2006, and 4 certified somnologists (Hodoba, Krmpotic, Racic, and Dogas) according to ESRS guidelines published in 2009.

**Educational programs**

Since 2003, University of Split and University of Zagreb: elective graduate and postgraduate courses for MDs (Sleep medicine, Sleep apnea);  
Regular annual or bi-annual CME courses (Sleep medicine, Sleep disordered breathing, Basic polysomnography, and Advanced polysomnography);  
Occasional International basic and advanced courses on sleep medicine and sleep disordered breathing.

**Present activities,  
working groups, task  
forces**

Presently active task forces:  
Task force for the reimbursement guidelines of the Croatian Department for Health Insurance,  
Task force of the Croatian Somnological Society for accreditation/certification procedure,  
Sleep technicians/nurses section of the Croatian Somnological Society,  
Task force for collaboration with the Croatian Ministry of Health in creating and adopting the legal documents on accreditation of sleep medicine centers, certification of sleep professionals, and education of sleep experts.  
Croatian Somnological Society is very active in collaboration with the patient group "Apnea".

**Miscellaneous**

Croatian Somnological Society – Society for Sleep Medicine of the Croatian Medical Association is using the official journal of the Croatian Medical Association named Lijecnicki vjesnik, which was founded in 1877.  
The Society is supporting and actively participating in the Brain Awareness Week, World Sleep Day, and Narcolepsy Day, which take place every year in March.

# The National Sleep Societies

## CZECH REPUBLIC



Česká společnost pro výzkum  
spánku a spánkovou medicínu  
Czech Sleep Research and Sleep Medicine Society



Current President: Prof. Dr. Karel Šonka

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<b>Foundation year</b>	2001
<b>Webpage</b>	<a href="http://www.sleep-society.cz/">http://www.sleep-society.cz/</a>
<b>Number of members</b>	177
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	Neurology: 60, Respiratory medicine: 40, ENT: 24, Psychiatry + Psychology: 15, Internal medicine + cardiology: 4, Pharmacology 2, GP: 1, Neurophysiology: 3, Technicians: 28.
<b>Historical perspective of the society</b>	Despite the fact that Bedřich Roth started to examine sleep in Prague in 1951, the real development of Czech sleep medicine began after the change of regime in the 1990s. Since 1991, Prague neurologists have held annual meetings devoted to sleep disorders. Later, one of these meetings was attended by other specialists, and in 2001, M. Moráň, S. Nevšímalová, P. Rambousek, P. Smolík, K. Šonka, M. Trefný, and J. Vyskočilová founded the Czech Society for Sleep Research and Sleep Medicine. Dr. K. Šonka, elected President of the Society, has been serving in this position to this day.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Clinical research: Bedřich Roth, Jaroslava Dittrichová, Soňa Nevšímalová, Karel Šonka
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	11, the list is on Society website: <a href="http://www.sleep-society.cz/pracoviste/akreditovana-centra.html">http://www.sleep-society.cz/pracoviste/akreditovana-centra.html</a>
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	3
<b>Accreditation / Certification procedure</b>	The accreditation process inspired by ESRS rules started in 2005. The process is completely managed by the Society and the status of an accredited Sleep Centre is recognized by health insurance companies but not by the state authorities.
<b>Educational programs</b>	Since 2006, the Society has been organising biennial theoretical courses in sleep medicine followed by theoretical and practical examinations.
<b>Present activities, working groups, task forces</b>	In cooperation with Slovak colleagues, the Society organizes annual Czech and Slovak Sleep Congresses. The Society collaborates with other medical societies in the discussion with state health care authorities and health insurance agencies.  Working groups: Ventilation in sleep, Cardiology and sleep
<b>Miscellaneous</b>	The Society was the local organiser of the successful 17 <sup>th</sup> ESRS Congress held in Prague in October 2004 (with Soňa Nevšímalová chairing the local organising committee). With ESRS support, the Society organised an International Symposium on Narcolepsy and Hypersomnia in 2009 to mark the unattained 90 <sup>th</sup> birthday of Bedřich Roth. The Society tries to promote research by awarding the best publications of the year and by supporting presenters in ESRS or WASM or APSS congresses.

# The National Sleep Societies

## DENMARK



### Dansk Søvnmedicinsk Selskab Danish Society for Sleep Medicine



Current President: Prof. Dr. Poul Jennum

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<b>Foundation year</b>	1996
<b>Webpage</b>	<a href="http://www.dssm.dk">www.dssm.dk</a>
<b>Number of members</b>	68
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	Mostly M.D. in the specialties: clinical neurophysiology, neurology, ear-nose-throat, and pulmonology. Other members are psychologists, masters, PhDs.
<b>Historical perspective of the society</b>	The society was founded in 1996 by a group of physicians. The society has held 1 – 3 national meetings per year and meetings with related societies. Activities include creation of sleep diagnoses for the national patient registry, creating of diagnose related groups for all sleep procedures, guideline programs, accreditation, and national meetings.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Members of the board: Pia Würtzen Norup, Poul Jennum (chairmen) Niels Rasmussen, Ole Nørregaard, Jørgen Alving, Michael Laub, Klaus Martiny, Marielle Zoetmulder, Stine Knudsen, Birgitte Bang, Lene Ruge Møller, Michael Felding, Mary Doreen Atkins, Gordon Wildschjødtz, Jan Ovesen, Søren Berg
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	Danish Center for Sleep Medicine, Glostrup Hospital <a href="http://www.glostruphospital.dk/menu/Afdelinger/Soevncenter/">http://www.glostruphospital.dk/menu/Afdelinger/Soevncenter/</a> Respiratory Center West, Århus University Hospital Respiratory Center East, Glostrup Hospital, Copenhagen Scansleep, Copenhagen <a href="http://www.scansleep.eu">www.scansleep.eu</a>
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	There are several active groups working within the sleep field. The National Sleep Center is: <a href="http://www.glostruphospital.dk/menu/Afdelinger/Soevncenter/">http://www.glostruphospital.dk/menu/Afdelinger/Soevncenter/</a> ScanSleep is active in research and education <a href="http://www.scansleep.eu">www.scansleep.eu</a>
<b>Accreditation / Certification procedure</b>	Denmark participated in the grandparenting process of sleep medicine professionals organized by the Nordic NOSMAC organization in 2010.
<b>Educational programs</b>	National sleep courses Pre- and postgraduate education Sleep scoring programs
<b>Present activities, working groups, task forces</b>	Health Technology Assessment (2006, 2007) and revision in 2012 Representation in the National Health Board
<b>Miscellaneous</b>	Nordic Sleep Congress held in 2003, to be organized in 2013

# The National Sleep Societies

## ESTONIA



### Eesti Unemeditsiini Selts Estonian Sleep Medicine Association



Current President: Dr. Erve Sõõru

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<b>Foundation year</b>	2005
<b>Webpage</b>	<a href="http://www.unemeditsiin.ee">http://www.unemeditsiin.ee</a>
<b>Number of members</b>	27
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	13% Oto-rhino-laryngologists, 13% Cardiologists, 10% Pulmonologists, 10% PhDs, 8% Dentists, 8% Psychiatrists, 8% Neurologists, 30% Miscellaneous (Psychologists, Nurses, Technicians, etc.)
<b>Historical perspective of the society</b>	<p>In 1996, the first sleep disorders centre was founded in Psychiatry Clinic of Tartu University Hospital. Dr. Tuuliki Hion was the first MD to work for this centre followed by Dr. Marlit Veldi (1997 – 2003). The full spectrum of sleep disorders was diagnosed and treated. In 1997, the first polysomnography was performed.</p> <p>The first treatment with CPAP in Estonia was applied in the Lung Clinic, Tartu University Hospital, on october 1997 by Dr. Erve Sõõru. Her main interest is the diagnostis and treatment of sleep-disordered breathing.</p> <p>Professional society: The Estonian Sleep Medicine Association was founded on April 16, 2005, with Dr. Mae Pindmaa as the first president.</p>
<b>Important sleep physicians / researchers in the history of the NSS</b>	Clinical research: Tuuliki Hion, Rain Jõgi, Jüri Kaik, Mae Pindmaa, Heisl Vaher, Marlit Veldi, Silja Virolainen, Erve Sõõru
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	5 For a complete list see: <a href="http://www.unemeditsiin.ee">http://www.unemeditsiin.ee</a>
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	5 Sleep Disorders Centre, Psychiatry Clinic of Tartu University Hospital, Tartu, chair Dr. Tuuliki Hion; Sleep Medicine Centre, Ear Clinic of Tartu University Hospital, Tartu, chair Dr. Marlit Veldi; Lung Clinic of Tartu University Hospital, Tartu, chair Dr. Rain Jõgi Department of Pulmonology, North Estonia Medical Centre Foundation, Tallinn, chair Dr. Erve Sõõru; Mae Pindmaa Sleep Clinic, Tallinn and Võru, chair Dr. Mae Pindmaa
<b>Accreditation / Certification procedure</b>	We do not have special studies in universities for a certificate in sleep medicine. We started to regulate sleep medicine studies and accreditation in our country.
<b>Educational programs</b>	Workshops for continuing education are organized at the society meetings (4 times per year).
<b>Present activities, working groups, task forces</b>	We collaborate with other societies for scientific meetings and workshops, keynote lectures, oral presentations 2 – 4 times per year. We have workgroups with our Ministry of Social Affairs and Health Insurance. We are the local organizers of the 22 <sup>th</sup> Congress of European Sleep Research Society which takes place in Tallinn in 2014.
<b>Miscellaneous</b>	First PhD in sleep: Dr. Marlit Veldi, 2001 (supervisor Dr. Veiko Vasar), „Obstructive sleep apnoea: computerized endopharyngeal myotonometry of the soft palate and lingual musculature“, Psychiatry Clinic of Tartu University Hospital. First patient’s organization: Estonian Association of Sleep Apnoea Patients, founded 2007.

# The National Sleep Societies

## FINLAND



### Suomen Unitutkimus seura Finnish Sleep Research Society



Current President: Dr. Salla Lamusuo

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<b>Foundation year</b>	1988
<b>Webpage</b>	<a href="http://www.sus.fi/">www.sus.fi/</a>
<b>Number of members</b>	201
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	Membership constitutes mostly of professors, PhDs, MDs, physicists, psychologists, biologists and sleep technicians. Most frequent specialties are: pulmonologists, neurologists, clinical neurophysiologists, pediatricians, child neurologists, psychiatrists.
<b>Historical perspective of the society</b>	Finnish Sleep Research Society was founded in 1988 by both sleep clinicians and sleep researchers to promote sleep research, sleep medicine, psychological therapy, and sleep education. Since then it has been an active meeting place for different disciplines interested in various aspects of sleep.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Markku Partinen, Joel Hasan, Dag Stenberg, Tarja Porkka-Heiskanen, Christer Hublin, Olli Polo, Tarja Saaresranta, Sari-Leena Himanen, Tiina Paunio, Tiina Telakivi, Turkka Kirjavainen, Hannu Lauerma, Juha Markkula, Erkki Kronholm, Mikko Härmä, Soili Kajaste, Pirkko Brander, Raija-Leena Punamäki, Päivi Polo, Juulia Paavonen, Outi Saarenpää-Heikkilä, Katja valli, Timo Partonen, Mikael Sallinen.
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	There are 11 Sleep Medicine Centers with full polysomnography: Helsinki University Central Hospital, Turku University Hospital, Kuopio University Hospital, Oulu University Hospital, Tampere University Hospital, Satakunta Central Hospital in Pori, Savonlinna Central Hospital, Vitalmed Sleep Center in Helsinki, Institute of Occupational Health in Helsinki, Unesta Ltd. In Tampere, Sleep Research Unit of University of Turku, Oivauni Sleep Clinic in Kuopio. In addition, there are numerous sleep apnea centers with cardiorespiratory polygraphies in both municipal and private clinics.
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	There are 6 main Sleep Research Centers: Helsinki University, Turku University, Tampere University Hospital, Unesta Ltd. in Tampere, Vitalmed Sleep Centre in Helsinki, Institute of Occupational Health in Helsinki, Finnish Institute for Health and Welfare in Helsinki.
<b>Accreditation / Certification procedure</b>	Finnish Sleep Research Society has special certification/education program for MDs, which constitutes of clinical education with theoretical and hands on-exam. After completing the program the applicant can receive the title "Special Competence in Sleep Medicine" by Finnish Medical Society. Many Finnish Sleep Clinicians have Nosmac accreditation. Experienced Sleep Researches can apply for the nomination "Expert in Sleep Research" granted by the Finnish Sleep Research Society.
<b>Educational programs</b>	Please, see above.
<b>Present activities, working groups, task forces</b>	The society organizes National Sleep Symposia twice a year. Committees for "Special Competence in Sleep Medicine" and "Expert of Sleep Research" plan educational programs and approve programs of individual applicants.

# The National Sleep Societies

## FRANCE



Current President: Prof. Jean-Louis Pépin

### Société Française de Recherche et Médecine du Sommeil French Sleep Research and Medicine Society

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<b>Foundation year</b>	1984
<b>Webpage</b>	<a href="http://www.sfrms.org/">http://www.sfrms.org/</a>
<b>Number of members</b>	400
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	27% Pneumologists – 27% Neurologists – 13% ENT surgeons – 10% Psychiatrists – 10% GPs – 13% others
<b>Historical perspective of the society</b>	The French Sleep Research and Medicine Society (SFRMS) is a scientific non-profit organization, which brings together clinical and basic science researchers, and healthcare professionals. The society organizes the accreditation process for sleep centers and provides standards for education. The main goal is now to facilitate development of sleep medicine as a subspecialty, and to initiate research networks.
<b>Important sleep physicians / researchers in the history of the NSS and Past presidents</b>	Michel Jouvet, Michel Billiard, Jean Krieger, Odile Benoit, Joëlle Adrien, Emmanuel Weitzenblum, Patrick Lévy, Daniel Kurtz, Alain Besset, Michel Autret, Marie-Jo Challamel, Louis Arbus, Claude Gaultier, F Leygonie-Goldenberg, Jean Louis Valatx, Dominique Samson-Dollfus, Jacques Paty, Alain Muzet, Bruno Claustrat, Dominique Pringuey, Lucile Garma, Pierre Passouant, Claude Gottesmann, Marie Françoise Vecchierini, Joel Paquereau, Daniel Gieu.
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	52 certified centers For a complete list: <a href="http://www.sfrms-sommeil.org/CARTE/carte-sommeil-web.html">http://www.sfrms-sommeil.org/CARTE/carte-sommeil-web.html</a>
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	Main centers currently involved in a research network (Groupement de recherche (GDR)): Pierre Philip / Colette Fabrigoule GENPPHAASS USR CNRS 3413 SANPSY (Sleep, Attention and NeuroPSYchiatry); Pierre Hervé-Luppi Physiopathologie des réseaux neuronaux du cycle veille-sommeil. Rattachement (EPST, INSERM, CNRS): Université Lyon 1 et CNRS; Isabelle Arnulf Mouvements et ganglions de la base CRICM-UPMC – Paris 6; Inserm UMR_S 975; CNRS UMR 7225; Karim Benchenane Laboratoire de Physiologie de la Perception et de l'Action, UMR CNRS 7152, Collège de France; Patrice Bourgin CNRS – UPR 3212 – INCI / Équipe n°4: Lumière, rythmes, homéostasie du sommeil et neuropsychiatrie; Imad Ghorayeb CNRS UMR 5293 Institut des maladies neurodégénératives – Physiopathologie des syndromes parkinsoniens; Agnès Daurat 5263 CNRS – EPHE Université Toulouse II; Yves Dauvilliers Pathologies neuropsychiatriques, neurologie, épidémiologie et clinique (INSERM U888, Pathologies du système nerveux: recherche épidémiologique et clinique); Véronique Fabre/Joelle Adrien Sommeil, Neurotransmission: physiologie, anatomie fonctionnelle et biologie moléculaire Rattachement (EPST, INSERM, CNRS): Inserm/Cnrs/Université Pierre et Marie Curie Paris 6; JS LIN – Karine Spiegel – Patricia Franco Physiologie intégrée du système d'éveil Inserm U1028/cnrs UMR 5292/ Université Claude Bernard/HCL; Frederic Gagnadoux "Stress Oxydant et Pathologies Métaboliques (SOPAM) INSERM U 694; Claude Gronfier Département chronobiologie Institut Cellule Souche et Cerveau INSERM U846 69500 Bron; Géraldine Rauchs Unité Inserm U923, Caen Neuropsychologie Cognitive et Neuroanatomie Fonctionnelle de la Mémoire Humaine; Damien Davenne Mobilités: Attention, Orientation et Chronobiologie, INSERM ERI 27;

# The National Sleep Societies

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**Number of Sleep Research Centers (link to their titles and locations)**

- continued -

Marie-Pia d'Ortho INSERM U676 Equipe Contrôle respiratoire néonatal et troubles du développement; Patrick Levy/ Jean-Louis Pépin Unité Inserm 1042, Hypoxie et physiopathologies cardiovasculaire et respiratoire, Grenoble; Hélène Bastuji Intégration centrale de la douleur chez l'Homme Equipe 3, Centre de Neurosciences INSERM 2028 et Université Lyon; Olivier Rascol Anne Pavy-Le Traon CIC 9302 + U Inserm 825 Equipe 2: Handicaps neurologiques, stratégies thérapeutiques et plasticité cérébrale; Perrine Ruby Equipe "Dynamique Cérébrale et Cognition" INSERM U1028; José Medina CIC Plurithématique Pierre Drouin – INSERM – CHU de Nancy; Frédéric Roche EA Système Nerveux Autonome: Epidémiologie, Ingénierie, Santé rattachement CHU et université Saint-Etienne; A Quera Salva CIT 805 (CIC-IT Garches); P Escourrou EA3544, Sérotonine et Neuropharmacologie de l'Université Paris 11 Faculté de Pharmacologie; Christian Straus, Thomas Similowski (ER10 UPMC) Neurophysiologie respiratoire expérimentale et clinique Université Pierre et Marie Curie – Paris VI; Xavier Drouot EA 4391, Excitabilité Nerveuse et Thérapeutique; Damien Leger Centre du Sommeil et de la Vigilance Hotel Dieu APHP Université Paris Descartes; Michel Lecendreau – Eric Konofal CIC 9202-pharmacologie Université Paris VII; Lionel Naccache, Stanislas Dehaene, Pôles des Maladies du Système Nerveux, Pitié-Salpêtrière, Paris & Equipe "Neuropsychologie & neuroimagerie" au sein du CRICM UMRS INSERM 975; Christelle Monaca-M. Derambure EA 1046: maladie d'Alzheimer et pathologies vasculaires; Denis Theunynck, Recherche Littorale en Activités Corporelles et Sportives, EA 4110-ER3S

**Accreditation / Certification procedure**

The accreditation process was implemented according to the European Guidelines, 52 centers are currently certified

**Educational programs**

Annual scientific meeting each November (2.400 attendees in 2011).  
There is a national postgraduate program for the different specialities involved in sleep medicine and GPs, including 97 teaching hours. The students should spend at least 84 hours in a sleep lab for clinical practice.  
We also have Insomnia courses and different educational workshops in the day preceding the annual congress of the French sleep society covering the main issues in sleep medicine.  
Public activities: Sleep day

**Present activities, working groups, task forces**

We have a main executive committee with sub-committees such as accreditation committee and scientific committee. Several working groups are organized within the SFRMS around topics such as "Pediatric sleep", "chronobiology", "Insomnia", "hypersomnia, parasomnia and motor disorders". We provide guidelines for the main diagnosis and follow-up procedures (MSLT, polysomnography, MWT). The society is supporting research by annual funding (approximately 100,000 Euros) for PhD thesis or one year post doctoral position.  
We try to implement national prospective cohorts and to support multicenter studies  
We are working with other specialist bodies to promote sleep as a subspecialty.

# The National Sleep Societies

## GERMANY



### Deutsche Gesellschaft für Schlafforschung und Schlafmedizin (DGSM) German Sleep Society



Current President: Prof. Dr. Geert Mayer

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<b>Foundation year</b>	1992
<b>Webpage</b>	<a href="http://www.dgsm.de">http://www.dgsm.de</a>
<b>Number of members</b>	2.240
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	Internal Medicine (including pneumology) 60%, Psychiatry & Neurology (old specialisation) 13%, Paediatrics 10%, Neurologists 6%, Psychiatrists 5%, General medicine 2%, Dentistry 1%, Oto-Rhino-Laryngology 1,5%, Other 1,5%
<b>Historical perspective of the society</b>	1988 Foundation of the <i>Arbeitsgemeinschaft klinischer Schlafzentren</i> by the first 15 sleep laboratories 1989 Development of accreditation procedures. 1992 Foundation of the German Sleep Society (DGSM) 1992 Standardized accreditation of sleep laboratories 1994 Sleep specialists (somnologists) by the DGSM 2003 National acknowledgement of sleep medicine as sub-speciality 2001 First national treatment guideline (S2) for sleep disorders 2009 First evidence based national treatment guideline (S3) for sleep disorders
<b>Important sleep physicians / researchers in the history of the NSS</b>	Researchers in the history: W. Baust, C. Becker-Carus, M. Berger, P. Clarenbach, J. Fischer, U. J. Jovanovič, W. Kuhlo, R. Lund, K.-H. Meier-Ewert, J.-H. Peter, K.-H. Rühle, E. Rüther, Marianne E. Schläfke, H. Schulz, R. Steinberg, J. Zully Important sleep physicians: S. Andreas, M. Arzt, H. Becker, H. Benes, A. Bosse-Henck, H. Danker-Hopfe, I. Eisensehr, J. Ficker, I. Fietze, P. Geisler, G. Hajak, S. Happe, W. Hochban, B. Högl, M. Hornyak, S. Kotterba, D. Köhler, C. Lauer, G. Mayer, J. Maurer, W. Oertel, M. Orth, E. Paditz, T. Penzel, T. Podszus, T. Pollmächer, W. Randerath, F. Raschke, D. Riemann, A. Rodenbeck, T. Schäfer, B. Schönhofer, S. Scholle, R. Schulz, A. Steiger, K. Stiasny-Kolster, B. Stuck, H. Teschler, C. Trenkwalder, U. Voderholzer, T. Wetter, H.-G. Weeß, A. Wiater, M. Wiegand, J. Winkelmann, P. Young
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	320 Link: <a href="http://www.charite.de/dgsm/dgsm/schlaflabore_liste.php?language=english">http://www.charite.de/dgsm/dgsm/schlaflabore_liste.php?language=english</a>
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	There is no differentiation between Sleep Research and Sleep Medicine Centers. Some Sleep Medicine Centers hold beds for Sleep Research.

# The National Sleep Societies

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## Accreditation / Certification procedure

- Peer-reviewed quality assurance by a commission of the DGSM. Biannual evaluation on procedures, outcome, and quality by a standardised manual.
- Revisitation of sleep medicine centers: In case of change of director or person in charge of sleep medicine center.
- Certification of professionals: Certificate for physicians (by chamber of physicians), non-medical staff (by DGSM) and technicians (by DGSM)
- Examination of scientists by the DGSM as requested: 0.5 h theoretical, 0.5 h practical examination by 4 experts from different sleep fields.

## Educational programs

- Teaching courses (basic): 4 h basic courses in national congress, regular courses provided by the local DGSM groups (general physicians: 4 – 10 h, introduction into sleep medicine: 30 h, hands-on course: 20 h)
- Teaching courses (advanced): Curriculum sleep medicine 90 h, 4 – 6 h courses in national congress. 1.5 day theory and practice courses for technicians
- Workshops: organised locally
- Training facilities and fellowships at specified sleep medicine centers
- Training of sleep nurses and technologists at specified sleep medicine centers

## Present activities, working groups, task forces

- Sleep symposia within the conferences of the national societies of pneumology, neurophysiology & imaging, neurology, psychiatry, pediatry, ENT and dental medicine
- Workshops with young scientists
- Publication of national guidelines
- Publication of patient guidelines and patient brochures
- Cooperation with patient groups
- Negotiation with health authorities on reimbursement issues for sleep medicine.

### Task Forces:

Accreditation/quality assurance  
Payment of sleep medicine  
Education  
Medical devices  
Certification of Somnologists  
a) physicians  
b) psychologists/scientists  
c) technicians  
patient support groups  
FAQs, implementation and support of  
AASM PSG guidelines

### Working Groups:

Alertness Management  
Apnea  
Chronobiology  
Circulation and Sleep  
Diagnostics  
Dream  
Geriatrics  
Insomnia  
Methodology  
Movement Disorders  
Paediatrics  
Pathophysiology of Breathing  
Surgical Methods of Therapy  
Training and Education  
Vigilance

## Miscellaneous

Symposia/congresses: Annual national meeting  
Scientific awards: poster and scientific awards

# The National Sleep Societies

## GREECE



### ΕΛΛΗΝΙΚΗ ΕΤΑΙΡΙΑ ΕΡΕΥΝΑΣ ΤΟΥ ΥΠΝΟΥ (ΕΕΕΥ) Hellenic Sleep Research Society (HSRS)



Current President: Dr. Dimitris Dikeos

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<b>Foundation year</b>	1995
<b>Webpage</b>	<a href="http://www.sleep_med.gr">www.sleep_med.gr</a>
<b>Number of members</b>	55
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	The subscribed members are 55; 16 members are psychiatrists, 23 pulmonologists, 10 neurologists and 3 internists. Two of our members are psychologists and one member is a bioengineer.
<b>Historical perspective of the society</b>	<p>HSRS was established in 1995 in Athens. The founding members were 27; 8 of them were psychiatrists, 9 neurologists and 10 pulmonologists. Since its foundation until November 2011, president of the Society was Constantin R. Soldatos, Professor of Psychiatry in the Athens Medical School. In November 2011, Dr. Dimitris Dikeos, Associate Professor of Psychiatry in the Athens Medical School was elected as the new president of the Society and Professor Constantin Soldatos was declared honorary president of the Society. The Board consists of Emmanouil Vagiakis (Vice President, Pulmonologist), Antigone Papavasileiou (Secretary, Neurologist), Costas Psarros (Treasurer, Psychiatrist), and the members-at-large E. Daskalopoulou-Vlachogianni (Pulmonologist), S. Schiza (Pulmonologist), and A. Bonakis (Neurologist).</p> <p>Honorary members of our Society include: Michel Billiard, Professor of Neurology, Thomas Roth, Professor of Psychology and Anthony Kales Professor of Psychiatry.</p>
<b>Important sleep physicians / researchers in the history of the NSS</b>	Constantin R. Soldatos, Professor of Psychiatry in the Athens Medical School.
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	In Greece, there are 33 Sleep Medicine Centres, widely distributed in the country. For details: <a href="http://www.sleep_med.gr">www.sleep_med.gr</a>
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	There are 13 Sleep Research Centres, 6 in Athens, 4 in Thessaloniki, 1 in Crete, 1 in Larisa and 1 in Alexandroupoli. For more details visit our website <a href="http://www.sleep_med.gr">www.sleep_med.gr</a>
<b>Accreditation / Certification procedure</b>	Currently there is no official accreditation for sleep specialists in Greece. Sleep Centres get a certificate of approval by a special committee of the Hellenic Thoracic Society.
<b>Educational programs</b>	The Hellenic Sleep Research Society has organised three National Congresses on sleep disorders, as well as several national educational activities such as seminars, workshops, etc.
<b>Present activities, working groups, task forces</b>	The Hellenic Sleep Research Society has officially participated in numerous scientific events organised by other Societies. Over the last years, on World Sleep Day and on the European Narcolepsy Day, the Hellenic Sleep Research Society has organised events mainly in public places, and it has actively participated in press conferences, TV and Radio programs. The main aim of these actions is to better inform the general public about sleep disorders, their symptoms and about the overall approach to them. To this end, the Society has also produced and distributed several booklets on sleep disorders. The Hellenic Sleep Research Society participates in the Assembly of National Sleep Societies of the European Sleep Research Society.

# The National Sleep Societies

## HUNGARY



### Magyar Alvástársaság Hungarian Sleep Research Society



Current President: Prof. Dr. Zoltan Szakacs

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<b>Foundation year</b>	1997
<b>Webpage</b>	<a href="http://www.alvastarsasag.hu">www.alvastarsasag.hu</a>
<b>Number of members</b>	120
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	Approximately: 35 % Neurologists, 22% Pneumologists, 19% specialist in internal medicine, 11% Psychiatrists, 5% Psychologists, 4% Pediatricians and 4% Dentists.
<b>Historical perspective of the society</b>	The society was founded in Budapest in 1979. with the aim of organizing sleep medicine in Hungary, establishing competent Sleep Medicine Centres (SMC), providing the technical, organizational and personnel requirements for the operation of these centres, preparing advanced professional recommendations considered to be the basis of quality assurance in the fields of diagnostic and therapeutic procedures and having such recommendations recognized. Its first president was Prof. P. Halász.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Clinical research: Péter Halász, Köves Péter, Péter Rajna, Márta Novák, Mária Várszegi, Róbert Bódizs, Katalin Várdi Visy and Béla Faludi. Basic research: Ferenc Obál, György Benedek, György Ádám and László Détári
<b>Number of Sleep Medicine Centers</b>	13 For a complete list see: <a href="http://www.alvastarsasag.hu/index.php?pg=rolunk_detailed">http://www.alvastarsasag.hu/index.php?pg=rolunk_detailed</a>
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	1 For a complete list see: <a href="http://cogsci.bme.hu/Tag.php?tip=2&amp;nev=B%F3dizs%20R%F3bert">http://cogsci.bme.hu/Tag.php?tip=2&amp;nev=B%F3dizs%20R%F3bert</a>
<b>Accreditation / Certification procedure</b>	Following the guidelines of the European Sleep Research Society, the accreditation procedure of Hungarian sleep research laboratories was started in 2005. The Accreditation Committee established by the management audits the laboratories every 2 years and judges new applications by rating them in three categories: fully complies with SMC requirements, complies with SMC requirements with corrections, failed to comply. The training of somnologists and sleep technicians were therefore initiated in compliance with the guidelines issued by the European Sleep Research Society in 2009. A Committee for postgraduate training in Sleep Medicine was established which organizes training and examinations for medical specialists. The committee defined the requirements for theoretical and practical knowledge and elaborated the questions for the theoretical and practical examinations.
<b>Educational programs</b>	Educational workshops are organized at the annual meetings and credit points are provided.
<b>Present activities, working groups, task forces</b>	Our domestic activity includes the organizing of annual conferences, forums of further training, publication of reports and books on theoretical and practical knowledge in sleep medicine. The research results performed in Hungarian institutes are also published. The annual meeting includes training courses, a forum for exchange of experiences and the endorsement of co-operation between the participants of the network (somnologists, medical specialists, family doctors, sleep research technicians and specialized medical technicians). The highlighted subjects of these conferences are chosen to match the current fields of importance. Since 1999, further training activities in Sleep Medicine have been organized by the Semmelweis University of Budapest and conducted for medical specialists in the Honvédkórház ÁEK (Military Hospital – State Health Centre).

# The National Sleep Societies

## ICELAND



### Hið Íslenska Svefnrannsóknarfélag The Icelandic Sleep Research Society (ISRS)



Current President: Erna Sif Arnardottir

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<b>Foundation year</b>	1991
<b>Webpage</b>	<a href="http://www.svefnfelag.is">www.svefnfelag.is</a>
<b>Number of members</b>	19 paying members (>50 in total on post list)
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	MDs (pulmonology, general practice, ENT, pediatrics, clinical chemistry), psychologists, biologists, nurses, assistant nurses, biomedical engineers, etc.
<b>Historical perspective of the society</b>	Started informally in 1987 but was officially founded in 1991 by six founding members; Thorarinn Gislason, Helgi Kristbjarnarson, Bjorg Thorleifsdottir, Sigrídur Sigurdardottir, Bryndis Benediktsdottir and Julius Björnsson. The aim of the society has been from the beginning to increase awareness of sleep and sleep disorders among the public and health professionals as well as to increase and support sleep research in Iceland.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Thorarinn Gislason, Helgi Kristbjarnarson, and Bryndis Benediktsdottir.
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	Dept of Respiratory Medicine and Sleep, Landspítali – The National University Hospital of Iceland, Reykjavik, Iceland. 5 centers around Iceland have type 3 portable monitors for sleep apnea detection.
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	Dept of Respiratory Medicine and Sleep, Landspítali – The National University Hospital of Iceland, Reykjavik, Iceland.
<b>Accreditation / Certification procedure</b>	The Nordic Sleep Medicine Accreditation of the Nordic Sleep Assembly.
<b>Educational programs</b>	As a part of university education of health professions; MDs, psychologists and biomedical engineers.
<b>Present activities, working groups, task forces</b>	The ISRS holds educational conferences for its members and others working in sleep research every month. Also, the members of the society have been active in emphasizing the importance of sleep and sleep disorders in the Icelandic media: TV, radio, and newspapers. We are now assembling a taskforce to add material to our homepage for the Icelandic public. The ISRS also supports its members to go to international sleep conferences such as the ESRS.
<b>Miscellaneous</b>	We are a small society but also very active in sleep research and enjoy a research collaboration with many other countries such as Sweden and the US.

# The National Sleep Societies

## IRELAND



### Irish Sleep Society

Current President: Prof. Richard Costello

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<b>Foundation year</b>	2004
<b>Webpage</b>	<a href="http://www.irishsleepsociety.org/">http://www.irishsleepsociety.org/</a>
<b>Number of members</b>	45
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	Physicians, Dentists, Scientists, Specialist Nurses
<b>Historical perspective of the society</b>	The Society was formed in 2004 when the first meeting was attended by 50 people. Shortly after this meeting, a constitution was drafted and a President was elected. Subsequently, the Society drafted guidelines for national standards of investigation, management and treatment of the common sleep disorders. Since that time the Society has had an annual meeting which is usually attended by over 100 delegates, from across the specialties involved in sleep disorders. The meeting consists of expert presentations from International and National experts and primary research by National experts.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Professor McNicholas who was the President of the Irish Sleep Society is a former president of the European Respiratory Society. Professor McNicholas has an active research unit, with local and international collaborators
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	A comprehensive list of sleep centers is available at <a href="http://www.irishsleepsociety.org/issdirectory.htm">http://www.irishsleepsociety.org/issdirectory.htm</a> .
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	<a href="http://www.stvincents.ie/EDUCATION_and_RESEARCH_CENTRE/Respiratory_Group.htm">http://www.stvincents.ie/EDUCATION_and_RESEARCH_CENTRE/Respiratory_Group.htm</a>
<b>Accreditation / Certification procedure</b>	The Society Executive Committee is working on a process for accreditation of sleep centres but no specific policy has yet been adopted.
<b>Educational programs</b>	There are a number of "in-house" training programs at the University sleep centers. In addition there are training programs, see enclosed. <a href="http://www.irishsleepsociety.org/iss-training.htm">http://www.irishsleepsociety.org/iss-training.htm</a>
<b>Present activities, working groups, task forces</b>	The Irish Sleep Society is involved in drafting guidelines for accreditation of Sleep Laboratories in Ireland. The Irish Sleep Society is also working with the Department of Health on the possible association of influenza vaccination and narcolepsy.

# The National Sleep Societies

## ITALY



### Associazione Italiana di Medicina del Sonno (AIMS) Italian Sleep Medicine Society



Current President: Prof. Dr. Gian Luigi Gigli

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<b>Foundation year</b>	1991
<b>Webpage</b>	The AIMS activities are detailed in the web site ( <a href="http://www.sonnomed.it">www.sonnomed.it</a> ), which contains main information for both patients and physicians, links to all the major International sleep scientific societies and sleep journals, reports from different national Committees, guidelines, recommendations and official documents produced by the Society, local/national and international forthcoming meetings on sleep.
<b>Number of members</b>	350
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	AIMS has a clear multidisciplinary spirit, with regular members belonging to different medical and surgical specialties, including neurology, pulmonology, psychiatry, ENT, cardiology, pediatrics, child neurology, dentistry, and psychology.
<b>Historical perspective of the society</b>	The Italian Sleep Medicine Association (AIMS) is a scientific multidisciplinary society founded in 1990 by Prof. Elio Lugaresi and other Italian clinical sleep researchers. The first AIMS Congress was held in Bologna in 1991. The society's goals aim to spread knowledge on sleep medicine, promote research programs and organize epidemiological surveys in the sleep field.
<b>Important sleep physicians / researchers in the history of the NSS</b>	The current officers are Gian Luigi Gigli (President), Liborio Parrino (Vice President), Marco Zucconi (Secretary), and Alberto Braghiroli (Treasurer). Previous Presidents were Elio Lugaresi (Founder), Salvatore Smirne, Francomichele Puca, Mario Giovanni Terzano, Fabio Cirignotta, Luigi Ferini-Strambi, and Franco Ferrillo.
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	So far, 40 Centers of different levels of complexity (multidisciplinary 26, pulmonary-oriented 13, pediatric-oriented 1) have been accredited. They are distributed all over the country. ( <a href="http://www.sonnomed.it/">http://www.sonnomed.it/</a> )
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	See <a href="http://www.sonnomed.it/">http://www.sonnomed.it/</a> and Italian Sleep research Society (SIRS)
<b>Accreditation / Certification procedure</b>	Since 1995, AIMS offers a program of accreditation for Sleep Medicine Centers, based on expertise, appropriate instrumentation and clinical management of sleep disorders, and was preceded by teaching courses, training in multidisciplinary Sleep Centers and examination for the certification of the "Medical Sleep Expert".
<b>Educational programs</b>	The society's goals aim to spread knowledge on sleep medicine, promote research programs and organize epidemiological surveys on the sleep field. One of the major projects is continuous medical education and training courses to develop new Sleep Medicine Centers across the country. In this perspective, AIMS is ready to start a 2 <sup>nd</sup> -level post-doctoral University Master on Sleep Medicine, opened to medical doctors. Since 1997, AIMS organizes yearly a one-week residential Sleep Course for physicians, psychologists and technicians including formal lessons, clinical practice with sleep scoring, discussion of clinical cases, practice on diagnostic and therapeutic devices.

# The National Sleep Societies

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**Present activities,  
working groups, task  
forces**

Since 1992, AIMS organizes yearly a national Sleep Congress in different cities, where an accredited Sleep Center operates regularly. This event leads sleep physicians to share and debate new clinical and research data, meet experts from other countries and most of all offers the opportunity for young investigators to present updated results of trials and studies. The elections for the new board and executive committee of the Society are held every three years, on the occasion of the national Congress. We have 11 active Committees (Ventilation for Sleep Disordered Breathing, Accreditation of Sleep Centers, Sleep Expert Examination, Sleep and Gender, Scientific Committee for the Residential Course, Society Newsletter, Occupational Medicine, Sleepiness and Road Safety, ORL and Maxillo-Facial Surgery, Cardiology, and Dental Sleep Medicine).

**Miscellaneous**

In 2010 SIMSO (Italian Society for Dental Sleep Medicine) has been founded under the endorsement of AIMS.

# The National Sleep Societies

## ITALY



### Società Italiana di Ricerca sul Sonno (SIRS) Italian Sleep Research Society



Current President: Prof. Dr. Roberto Amici

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<b>Foundation year</b>	1995
<b>Webpage</b>	<a href="http://www.ricercasulsonno.it">www.ricercasulsonno.it</a>
<b>Number of members</b>	53
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	Physiologists and psychologists involved in basic sleep research on human subjects and animal models and in teaching to undergraduate and graduate students at academic Institutions.
<b>Historical perspective of the society</b>	The Italian Sleep Research Society was founded in 1995 to promote scientific interactions among laboratories of physiology and psychology committed to basic research on sleep and dreams at different academic Institutions throughout Italy. The Society has since then worked to foster basic sleep research with particular attention to training and support of young scientists.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Important sleep researchers in the history of the Italian Sleep Research Society include Mario Bertini, Marino Bosinelli, Carlo Cipolli, Igino Fagioli, Carlo Franzini, Mauro Mancia, Maurizio Mariotti, Pier Luigi Parmeggiani, Piero Salzarulo
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	In agreement with its mission focused on basic sleep research, the Society does not include sleep medicine centers.
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	Members of the Society direct or contribute to the activities of 12 Centers for Basic Sleep Research: Laboratory of Sleep Psychophysiology and Cognitive Neuroscience, University of L'Aquila ( <a href="http://sds.cc.univaq.it/index.php?id=282">http://sds.cc.univaq.it/index.php?id=282</a> ) Laboratory of Physiological Regulation in the Wake-Sleep Cycle, University of Bologna ( <a href="http://www.esrs.eu/membership-services/european-sleep-research-laboratories.html?tx_mnmesrslab_pi1%5Buid%5D=4">http://www.esrs.eu/membership-services/european-sleep-research-laboratories.html?tx_mnmesrslab_pi1%5Buid%5D=4</a> ) PRISM: Laboratory of Physiological Regulation in Sleeping Mice, University of Bologna ( <a href="http://www.esrs.eu/membership-services/european-sleep-research-laboratories.html?tx_mnmesrslab_pi1%5Buid%5D=5938">http://www.esrs.eu/membership-services/european-sleep-research-laboratories.html?tx_mnmesrslab_pi1%5Buid%5D=5938</a> ) Laboratory of Sleep and Dream Psychophysiology, University of Bologna ( <a href="http://www.psicologia.unibo.it/Psicologia/Risorse++strutture/Laboratori/LabPsicoSonSogn.htm">http://www.psicologia.unibo.it/Psicologia/Risorse++strutture/Laboratori/LabPsicoSonSogn.htm</a> ) Laboratory of Sleep Research, University of Florence Sleep Laboratory, University of Milan ( <a href="http://users.unimi.it/imeri/">http://users.unimi.it/imeri/</a> ) TMS-EEG Laboratory, University of Milan Laboratory of Sleep Psychophysiology, University of Naples II Laboratory of Sleep Psychophysiology, University of Padua ( <a href="http://ppl.psy.unipd.it/laboratory/SPL.htm">http://ppl.psy.unipd.it/laboratory/SPL.htm</a> ) Laboratory of Sleep Psychophysiology, University of Rome "Sapienza" ( <a href="http://w3.uniroma1.it/labsonno/">http://w3.uniroma1.it/labsonno/</a> ) Unit for the assessment and treatment of sleep disorders, University of Rome "Sapienza" ( <a href="http://w3.uniroma1.it/dip39/index.php/it/servizi/disturbi-del-sonno">http://w3.uniroma1.it/dip39/index.php/it/servizi/disturbi-del-sonno</a> ) Laboratory of Sleep Psychophysiology, University of Trieste
<b>Accreditation / Certification procedure</b>	None

# The National Sleep Societies

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**Educational programs**

None

**Present activities, working groups, task forces**

Present activities of the Italian Sleep Research Society include: organization of an Annual Scientific Meeting; organization of the "SIRS – Iginio Fagioli" Yearly National Prize for the best PhD or Medical Specialization thesis concerning basic sleep research; organization of public events to raise awareness of sleep research and sleep health among the general population and adolescents in particular.

**Miscellaneous**

The Society supports young scientist participating at the Annual Scientific Meeting through travel grants.

# The National Sleep Societies

## LITHUANIA



Current President: Dr. Vanda Liesiene

### Lithuanian sleep medicine society

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<b>Foundation year</b>	In year 2000
<b>Webpage</b>	www.neuromedicina.lt
<b>Number of members</b>	20
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	MDs (20): neurologists (6), pulmonologists (5), psychiatrists (5), cardiologists (2), otolaryngologists (2), PhDs (4), DSc (1), Professor (1).
<b>Historical perspective of the society</b>	The society was founded to support the development of sleep research and to facilitate the collaboration of different medical specialists in the diagnosis and treatment of sleep disorders (otolaryngologists, odontologists, neurologists, psychiatrists).
<b>Important sleep physicians / researchers in the history of the NSS</b>	Professor of neurology, DSc Vanda Liesiene developed basic sleep research models in animals and humans related to sleep and vegetative regulation. In clinical research, associations between sleep macrostructure, insomnia and emotional disorders were established.
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	Presently, there are 6 sleep medicine centres: Institute of Neuromedicine, Kaunas, Dept. of Pulmonology, Univ. Hospital Kaunas Medical University, Sapiega Hospital, Vilnius, Dept. of Neurology, Klaipeda University Hospital, Dept. of Pulmonology, Klaipeda Univ, Hosp., Dept. of Cardiology and Rehabilitation, Palanga.
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	Sleep research centre – Institute of Psychophysiology and Rehabilitation, Palanga
<b>Accreditation / Certification procedure</b>	The sleep medicine centre in Sapiega Hospital, Vilnius was accredited in the year 2009. Accreditation was made by the national sleep medicine society according to ESRS guidelines.
<b>Educational programs</b>	Edited book “Sleep Medicine”, regular lectures for family doctors, sleep training annual courses for neurologists, educational articles in local journals “Seminars of Neurology”, “Art of treatment”, booklets for patients.
<b>Present activities, working groups, task forces</b>	Working groups formed in every centre, development sleep apnea treatment, sleep and odontology, conference organization.
<b>Miscellaneous</b>	“Sleep day”, “Narcolepsy day” organization, advertisement for population, TV emissions on sleep disorders problems, popular educational articles about sleep problems in the local press.

# The National Sleep Societies

## THE NETHERLANDS



### Nederlandse vereniging voor Slaap- en Waak Onderzoek Dutch Society for Sleep-Wake Research



Current President: Hans L. Hamburger  
MD, PhD

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<b>Foundation year</b>	1989
<b>Webpage</b>	<a href="http://www.NSWO.nl">www.NSWO.nl</a>
<b>Number of members</b>	245
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	Basic research, Psychologists Neurologists, Clinical neurophysiologists, ENT, Pulmonologists, Pharmacologists, and Students
<b>Historical perspective of the society</b>	1985 Foundation of NSWO, Nederlandse vereniging voor Slaap- en Waak Onderzoek (Dutch Society for Sleep-Wake Research) Yearly 2 meetings Since 1989 yearly report of Sleep-Wake research in the Netherlands Since 2008 International Sleep Medicine Courses every 3 years Since 2011 accreditation of Sleep Medical Centres
<b>Important sleep physicians / researchers in the history of the NSS</b>	P. Visser, first researcher of sleep systems in animals A. C. Declerck first Sleep clinician Rutger Kopland or Rutger (Rudi) P. Hendrik van den Hoofdakker, psychiatrist and writer, who discovered light therapy to treat depression, A. Knuistingh Neven, first GP to study sleep, book Modern Sleep Medicine (1999) A. M. L. Coenen, A. L. van Bommel, G. S. F. Ruijt, H. A. C. Kamphuisen, G. A. Kerkhof, T. de Boer, D. Beersma, M. G. Smits, A. W. de Weerd, E. van Someren, G. J. Lammers, S. Overeem, J. Verbraeken, H. M. J. C. Verbeek, H. L. Hamburger
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	In 2011: 3 official accredited General Sleep Centres, and 80 OSA centers In 2012: 10 more General Sleep Centres will be accredited according to ESRS rules
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	See above <a href="http://www.kempenhaeghe.nl">www.kempenhaeghe.nl</a> <a href="http://www.sein.nl/diagnose-en-behandeling/locatiegegevens/slaapcentrum-sein-zwolle-ssz">www.sein.nl/diagnose-en-behandeling/locatiegegevens/slaapcentrum-sein-zwolle-ssz</a> <a href="http://www.slaapkliniek.nl">www.slaapkliniek.nl</a>
<b>Accreditation / Certification procedure</b>	Foundation for Accreditation of General Sleep Centres in the Netherlands according to ESRS guidelines as published in 2006
<b>Educational programs</b>	Since 2008: International Sleep Medicine Course (with B and UK), every 3 years a 4 full day course on physiology and clinical aspects of sleep/wake. In Nov 2011 2 parallel courses (basic and advanced) including half day hands-on sessions with 115 trainees from all over Europe, Australia and USA

# The National Sleep Societies

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**Present activities,  
working groups, task  
forces**

Clinical workgroups have been founded by Dentists in Sleep, Pulmonologists in sleep, Neurologists in Sleep, Psychologists in sleep, Technicians in sleep

Study groups for:

- Alertness Management and Vigilance
- Apnea/OSAS/therapy
- Circulation and Sleep
- Chronobiology
- Diagnostics
- Dream
- Geriatrics
- Insomnia
- Methodology
- Movement Disorders
- Paediatrics
- Surgical Methods of Therapy
- Training and Education

**Miscellaneous**

NSWO organizes 2 conferences per year on sleep medicine and sleep basic research  
Abundant basic research and clinical studies have been performed and are under way on Narcolepsy, OSA, Bruxism, Light therapy, RLS, see also above.

# The National Sleep Societies

## NORWAY



**Norsk forening for søvnforskning og søvn medisin**  
**Norwegian Society for Sleep Research and Sleep Medicine**  
(NSSRSM)



Current President: Michaela D. Gjerstad,  
MD, PhD

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<b>Foundation year</b>	1997
<b>Webpage</b>	<a href="http://nssrsm.b.uib.no/">http://nssrsm.b.uib.no/</a>
<b>Number of members</b>	150
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	Majority of physicians (ENT, GP, neurology, neurophysiology, pediatrics, pulmonology, psychiatry); psychologists, PhD's and others.
<b>Historical perspective of the society</b>	The society was founded in Bergen in 1997, to establish contacts between sleep researchers and clinicians, and to provide information about national and international activity within the field of sleep research and sleep medicine. Since 2006 the society has been working on accreditation of sleep specialists.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Reidun Ursin, Khalil Kayed, Mona Skard Heier, Inger Hilde Nordhus, Trond Bratlid, Bjørn BJORVATN, Ståle Pallesen, Kåre Gautvik, Børge Sivertsen, Fred Holsten, Harriet Akre, Olav Skatvedt, Magne Tvinneim, Harald Schrader, Trond Sand.
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	Center for Sleep Disorders, Haukeland University Hospital, Bergen. <a href="http://www.helse-bergen.no/omoss/avdelinger/senter-for-sovnmedisin/Sider/enhet.aspx">http://www.helse-bergen.no/omoss/avdelinger/senter-for-sovnmedisin/Sider/enhet.aspx</a> University Hospitals of Tromsø, Bodø, Trondheim, Oslo and Stavanger provide full diagnostic and treatment of sleep disorders. 54 actors (public and private) providing partly or complete diagnostic and treatment of sleep disorders. <a href="http://www.helsebergen.no/omoss/avdelinger/sovno/Sider/behandlingstilbod.aspx">http://www.helsebergen.no/omoss/avdelinger/sovno/Sider/behandlingstilbod.aspx</a>
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	Norwegian Competence Center for Sleep Disorders, Haukeland University Hospital, Bergen. <a href="http://www.sovno.no">http://www.sovno.no</a>
<b>Accreditation / Certification procedure</b>	22 "grandmothers" and "grandfathers" were accredited according to the interim regulation of the ESRS. Accreditation guidelines for Sleep labs, MDs, psychologists, technicians are currently under revision.
<b>Educational programs</b>	Workshops for continuing education are organized at the National Center for Sleep Disorders, Haukeland University Hospital, and Department of Neurology, University of Trondheim and at the National Center for ADHD, Tourette and Narcolepsy.
<b>Present activities, working groups, task forces</b>	Accreditation guidelines for MDs, psychologists, technicians are currently under revision. Other main aims: - To disseminate knowledge about sleep, sleep assessment and sleep disorders. - To unite professionals from many disciplines in the pursuit of knowledge about sleep. - To inform members and other interested parties about central conferences and meetings within the field of sleep research and sleep medicine. - To promote sleep research.

# The National Sleep Societies

## POLAND



### Polskie Towarzystwo Badań nad Snem (PTBS) Polish Sleep Research Society



Current President: Prof. Wojciech Jernajczyk

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<b>Foundation year</b>	1992
<b>Webpage</b>	www.medycynasnu.pl
<b>Number of members</b>	98
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	36 % Pulmonologists, 22 % Laryngologists, 18 % Psychiatrists, 15 % PhDs, 9 % Neurologists
<b>Historical perspective of the society</b>	<p>The society was founded in Warsaw in 1992. The first president of society was Prof. J. Narębski. In 2007 the conditions and procedures for the accreditation of sleep centers, and certification for physicians were formulated.</p> <p>Altogether, seven National PTBS Congresses were organized.</p>
<b>Important sleep physicians / researchers in the history of the NSS</b>	<p>Clinical research: Halina Ekiert, Karolina Jus, Andrzej Jus, Waldemar Szelenberger, Andrzej Kukwa, Zbigniew Zieliński, Robert Pływaczewski, Adam Wichniak, Wojciech Jernajczyk</p> <p>Basic research: Juliusz Narębski, Edyta Jurkowlaniec</p>
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	Centers with accreditation 9
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	Centers with accreditation 2
<b>Accreditation / Certification procedure</b>	<p>Accreditation of Sleep Medicine Centers procedure is based on guidelines of the Polish Sleep Research Society that comply with accreditation guidelines of the European Sleep Research Society with some exceptions, depending on local customs or regulations.</p> <p>Certification of professionals in sleep medicine is based on the certification program that complies with guidelines of the European Sleep Research Society with some exceptions, depending on local customs or regulations.</p>
<b>Educational programs</b>	<p>The Society organizes educational program on the following topics:</p> <ul style="list-style-type: none"><li>- Polysomnography and Diagnostics</li><li>- Sleep medicine for professionals from sleep apnea centers</li><li>- Sleep medicine for psychiatrists and neurologists</li></ul>
<b>Present activities, working groups, task forces</b>	<p>The following working groups are active in the Polish Sleep Research Society:</p> <ul style="list-style-type: none"><li>- Certification of physicians in Sleep Medicine</li><li>- Certification in Sleep Medicine for technicians</li><li>- Accreditation of sleep laboratories</li><li>- Transfer of the ESRS and AASM guidelines</li><li>- Training and Education in Sleep Medicine</li><li>- Reimbursement management in sleep medicine</li></ul>
<b>Miscellaneous</b>	<p>The Society honors Polish scientists who have demonstrated excellence in sleep research with the Prof. Juliusz Narębski Award</p>

# The National Sleep Societies

## PORTUGAL



### Associação Portuguesa de Sono Portuguese Sleep Association



Current President: Marta Gonçalves

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<b>Foundation year</b>	1991
<b>Webpage</b>	www.apsono.com
<b>Number of members</b>	254
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	Pneumologists: 21,1 %, Psychiatrists: 18,6 %, Neurologists: 12,7%, Psychologists: 5,9%, Pediatricians: 4,6 %, ENT: 4,2 %, Dentistry: 1,3 %, Other Medical specialties: 4,6 %, Technicians: 21.9%, Engineers: 2.1 %, Other occupations: 3 %
<b>Historical perspective of the society</b>	The Portuguese Sleep Association (APS) was created in 21-10-1991 to promote research, awareness and education relating to the study of sleep and sleep disorders. In order to carry out it's goals, the Association pledges to encourage and implement the assembly of doctors and researchers. Since it's creation, the APS has organized several meetings that significantly contributed to improve Portuguese sleep science. APS has also been active in promoting awareness campaigns for the general public.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Agostinho Rosa, António Atalaia, António Martins da Silva, Carlos Fernandes, Cristina Bárbara, Filipe Arriaga, João Carlos Winck, Joaquim Moita, José Moutinho dos Santos, Helena Estevão, Maria Helena Azevedo, Marta Gonçalves, Teresa Paiva, Vanda Clemente.
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	There are several public and private sleep medicine centers across the country, although none of them is yet accredited. The process of accreditation should start soon.
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	Porto – Hospital de Santo António/Centro Hospitalar do Porto, Hospital de S. João – Oporto Medical School, Centro Hospitalar de Vila Nova de Gaia, Instituto do sono – Centro Clínico e Investigação Aveiro – Department of Education, University of Aveiro Coimbra – Medical School, University of Coimbra; Centro de Medicina de Sono, CHUC Lisbon – Centro Hospitalar Lisboa Norte, Molecular Medicine Institute, Lisbon Medical School, University of Lisbon, CENC – Centro de Medicina de Sono.
<b>Accreditation / Certification procedure</b>	Sleep Medicine Competency approved by Medical Association in June 2012.
<b>Educational programs</b>	There are no specific curricula for Sleep Medicine in Portugal since Sleep Medicine is not yet recognized as an isolated medical specialty. The main sources of education for health care providers include: - Teaching courses for GP's or other specialties organised locally in connection with sleep medicine centers. - The APS organizes a course, every two years, concerning different aspects of Sleep Medicine. - In Oporto University Medical School there is a PhD Clinical Neuroscience, Neuropsychiatry and Mental Health programme with a specific Sleep Medicine module that started in 2011 – 2012, coordinated by Marta Gonçalves, MD, MsC. - In Lisbon University Medical School there were 6 editions of a Master Degree of Sleep Sciences, held during 2005 – 2011. During the same period there were also 5 graduations in Sleep Sciences. These courses were chaired by Teresa Paiva, Md, PhD.

# The National Sleep Societies

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**Present activities,  
working groups, task  
forces****Activities:**

- Publication of brochures concerning different aspects of sleep science. These brochures are available as valuable educational tools for the general public, patients and health care providers.
- Awareness campaigns for the general public about sleep. During the last two years the themes were sleep disorders and sleepiness at the wheel.
- Epidemiologic studies at national level (Insomnia; Drivers' sleepiness and countermeasures).

**Work groups:**

- Sleep Medicine accreditation Work Group.

# The National Sleep Societies

## ROMANIA



Current President: Stefan Dan Mihaicuta, MD, PhD

### Societatea Romana de Somnologie (SRS) Romanian Sleep Society

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<b>Foundation year</b>	SRS founded in 2006, a working group on sleep was initiated in 1976 by Prof. Popoviciu
<b>Webpage</b>	<a href="http://www.srp.ro/Somnologie-144">www.srp.ro/Somnologie-144</a>
<b>Number of members</b>	100
<b>Composition of members</b>	80 % Pulmonologists, 5 % Cardiologists, 5 % Neurologists, 5 % ENT, 5 % others. Separate Association of Technicians with 24 members.
<b>Historical perspective of the society</b>	Prof Popoviciu was the Chair of Local Committee for 4 <sup>th</sup> ESRS Congress, Tirgu-Mures, Romania, September 11 – 15, 1978. Michel Jouvet criticised the communist regime at the opening ceremony, and a team conducted by J. L. Valatx asked and obtained permission to visit political prisoners during the Congress. The special lecture given during the Congress was by Michel Jouvet on Paradoxical sleep and genetic programming of the brain. The congress proceedings were published in Sleep 1978. The current, independent sleep society was founded in 2006 by Prof. Mihaltan and it started from the Respiratory Society.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Nathaniel Kleitman (April 26, 1895 Kishinev, Romania – August 13, 1999 USA) was Professor in Physiology at the University of Chicago. He was the author of the important book “Sleep and Wakefulness”, published in 1939, he is recognized as the father of American sleep research. Kleitman, along with his student Eugene Aserinsky, was the first to discover rapid eye movement (REM) sleep and demonstrate that it was correlated with dreaming and brain activity. Liviu Popoviciu, local chair of 4 <sup>th</sup> ESRS Congress. Oskar Sager (1894 – 1981), neurologist, Arthur Kreindler (1900 – 1988), neurologist. Mircea Steriade, a prominent researcher in neuroscience, born in Bucharest, Romania, August 20, 1924, passed away in Canada April 14, 2006. He was among the first to study the dynamics of the brain during sleep, and one of his key discoveries was determining the role of thalamic reticular neurons as pacemakers in producing the sleep spindle rhythm. Florin Amzica, sleep researcher in Montreal, Canada, discovered important cellular substrates and laminar profiles of the K-complex in sleep. Florin Mihaltan, Stefan Mihaicuta, Daniela Boisteanu, Doina Todea, Oana Deleanu
<b>Number of Sleep Medicine Centers</b>	A total of 54 sleep units are in operation in 2012, 7 sleep medicine centers with full spectrum of sleep disorders, 47 units predominately to diagnose and treat sleep disordered breathing.
<b>Accreditation / Certification procedure</b>	Accreditation initiated in 2010, 5 centers are accredited including full polysomnography. In 2011, competence in somnology acquired after 6 months of training was officially recognized as an area of specific competence by the National Health Authorities.
<b>Educational programs</b>	Five Sleep Medicine books and courses since 2005, 4 National Conferences including Sleep E-Learning in 2012: 40 hours online studies followed by a 2 days meeting with lectures, 5 meetings within the European project FP7 – Human Resources. Competence in sleep medicine: Program for specialists in pneumology, neurology, cardiology, general practitioners, ENT, internal medicine including 6 months of training and a final examination based on the ESRS Catalogue of Knowledge and Skills.
<b>Present activities, working groups, task forces</b>	Sleep in children (Mihaela Oros), Cardiovascular diseases and Sleep disorders (Dan Mihaicuta, Dan Lighezan, Oana Deleanu, Florin Mihaltan), Metabolic consequences of OSA (Doina Todea), SAS and COPD (Daniela Boisteanu), Obesity – hypoventilation syndrome (Stefan Dumitrache – Rujinski)

# The National Sleep Societies

## RUSSIAN FEDERATION



### Rossiyskoe obshchestvo somnologov Russian Society of Somnologists



Current President: Prof. Dr. Vladimir Kovalzon

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<b>Foundation year</b>	2007
<b>Webpage</b>	<a href="http://www.sleep.ru">www.sleep.ru</a>
<b>Number of members</b>	70
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	PhD., M.D., M.S. and postgraduate students, neuroscientists, psychophysicologists, neurologists who are professionally engaged in animal sleep, sleep studies in healthy humans or in clinical sleep research in patients.
<b>Historical perspective of the society</b>	After the death of Prof. Aleksandr Vein in 2003, the leader of sleep medicine and human sleep physiology in Russia, the International Somnological Society of the Commonwealth of Independent States which he had founded and chaired in 1996, expired. At this time, the national laws were changed and the legislative base of the society did not exist any more. Trying to create a new professional organization, we established a somnological section at the Pavlovian Physiological Society of the Russian Academy of Sciences. We named our section the "Russian Somnological Society" because at that time there existed no other professional organization for sleep research and sleep medicine in Russia. Nevertheless, the National Society for Somnology and Sleep Medicine led by Yakov Levin (the 1 <sup>st</sup> State Medical University, Moscow) which unites mostly medical doctors (neurologists, pneumologists and others), was founded in Moscow in 2010. The latter organization now continues to support the conferences entitled "Actual problems of somnology" every second year, started by Prof. A. Vein as early as 1998. The 8 <sup>th</sup> Conference will take place in Moscow, November 22 – 23, 2012. After the sudden death of Prof. Levin on March, 31, 2012, the Society is now led by his successor Mikhail G. Poluektov, M.D. Integration of both Societies into the Russian Sleep Federation is now under discussion among the members.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Nikolay I. Grashchenkov (died in 1966) organized the Laboratory of Nervous and Humoral Regulations in the USSR Academy of Sciences in Moscow; Aleksandr M. Vein (died in 2003), the founder of sleep medicine and human sleep physiology in Russia, and Lev Latash (died in 2002 in the U.S.A.); Aleksandr N. Shepovvalnikov, the author of the first Russian monograph "Activity of the sleeping brain" (1971) who is actively working as before at the Sechenov Institute of Evolutionary Physiology and Biochemistry, Russian Academy of Sciences, S.-Petersburg; Aleksandr B. Kogan (died in 1989), the chief of the physiology school in Rostov-on-Don; Tengiz N. Oniani (died in 2012), the chief of the Georgian sleep school, Tbilisi.
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	About 50 Sleep Medicine Centers in Russia, including more than 20 centers in Moscow, the most important of them led by: A.L. Kalinkin <a href="http://www.sleeplab.ru">http://www.sleeplab.ru</a> ; M.G. Poluektov <a href="http://www.sleepmed.ru">http://www.sleepmed.ru</a> ; R.V. Buzunov <a href="http://www.sleepnet.ru">www.sleepnet.ru</a> ; G.V. Kovrov <a href="http://www.mma.ru/rescenter/resdep/patvns">http://www.mma.ru/rescenter/resdep/patvns</a> ; M.V. Agaltzov <a href="http://www.gnicpm.ru">http://www.gnicpm.ru</a> .
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	7 Sleep Research Centers, among them located at: Sechenov Institute Evolutionary Physiology/Biochemistry, Russian Academy of Sciences (RAS), S.-Petersburg (3 labs); Institute Higher Nervous Activity/Neurophysiology, RAS, Moscow (1 lab); Severtsov Institute Ecology/Evolution, RAS, Moscow (2 groups); Kharkevich Institute Information Transmission, RAS, Moscow (1 group); Sechenov 1 <sup>st</sup> Moscow State Medical University (4 clinical research groups); Southern Federal University, Rostov-on-Don (1 lab), Southern Scientific Center, RAS, Rostov-on-Don (1 lab).
<b>Accreditation / Certification procedure</b>	At Sechenov 1 <sup>st</sup> Moscow State Medical University, Dept. Nervous Diseases. The procedures of accreditation of sleep medicine centers and certification of sleep medicine experts are now in the process of elaboration in accordance to domestic guidelines.

# The National Sleep Societies

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## Educational programs

Sechenov 1<sup>st</sup> Moscow State Medical University (Dept. Nervous Diseases) sleep medicine education program for graduated students; Lecture courses and postgraduate students at: Lomonosov Moscow State University (Psychological and Fundamental Medical Faculties); Southern Federal University, Rostov-on-Don.

Postgraduate students also at: Sechenov Institute Evolutionary Physiology/Biochemistry, RAS, S.-Petersburg; Institute Higher Nervous Activity/Neurophysiology, RAS, Moscow; Southern Scientific Center, RAS, Rostov-on-Don.

## Present activities, working groups, task forces

Sechenov Inst. Evolutionary Physiology/Biochemistry, RAS, S.-Petersburg:

- Y.F. Pastukhov and his lab (molecular mechanisms of sleep in mammals and birds);
- G.A. Oganessyan and his lab. (phylo- and ontogenetic aspects of sleep-wake regulation, interrelation between sleep and epilepsy);
- A.N. Shepovalnikov and his group (human EEG in waking, sleeping and altered states of consciousness).

Southern Federal University, Rostov-on-Don:

- A.A. Burikov and his lab. (sleep-wake neurophysiology in humans and animals).

Southern Scientific Center, RAS, Rostov-on-Don:

- E.V. Verbitskiy and his lab. (sleep and anxiety in humans, sleep in mammals).

Severtsov Inst. Ecology/Evolution, RAS, Moscow:

- L.M. Mukhametov and his group (sleep-wake characteristics in marine mammals);
- V.M. Kovalzon and his group (sleep disturbances in experimental models of important diseases).

Kharkevich Institute Information Transmission, RAS, Moscow:

- I.N. Pigarev (autonomic influences upon animal sleep).

Institute Higher Nervous Activity/Neurophysiology, RAS, Moscow:

- V.B. Dorokhov and his lab (effects of stress and tiredness on human sleep; sleep and memory in humans and animals).

Sechenov 1<sup>st</sup> Moscow Medical University:

- Scientific Center, Department of Pathology of the Autonomic Nervous System, directed by Prof. G.V. Kovrov (Neurology of sleep-wake disorders. Neurophysiological & psychological studies of sleep and adaptation during international experiments on extended human isolation in a framework of the Programs MARS-105 & MARS-500, 2008-2011).
- Faculty of Postgraduate Professional Education of the Physicians, Department of Nervous Diseases, directed by Prof. V.L. Golubev (Sleep disorders).

Moscow Center of Sleep Medicine, directed by Dr. M.G. Poluektov:

- (Studies and treatment of insomnia, snoring, sleep apnoe, movement disorders during sleep, sleep disorders in epilepsy, sleep and stress, sleep disorders in children).

Hospital No. 83 of the Federal Medical-Biological Agency, Sleep Disorders Center, directed by

Dr. A.L. Kalinkin (Snoring and other breathing disorders during sleep, insomnia, hypersomnia, movement disorders during sleep, sleep-related epilepsy, sleep-related headache, sleeptalking).

Clinical Sanatorium "Barvikha" of the Administration of Affairs of the President of the Russian Federation, Sleep Medicine Division, directed by Prof. R.V. Buzunov (snoring and sleep apnoe, sleep and driving, insomnia, restless legs, circadian disturbances, other sleep disorders).

The Center for Prevention Medicine, Somnology lab, directed by Dr. M.V. Agaltzov (the study of sleep in patients, treatment of snoring and sleep apnoe).

## Miscellaneous

The activity of our society is directed mainly to organizing the International Sleep Workshops "Sleep as a window to the world of wakefulness" in Moscow or Rostov-on-Don in the odd years, supported by IBRO and some Russian foundations. The last, 6<sup>th</sup> workshop took place in October, 6-8, 2011, in Moscow. Total amount of registered participants was 65, coming from Belgium, Belorussia, Czech Rep., Finland, Germany, Holland, Italy, Canada, Romania, Ukraine, USA and 4 cities of Russia.

# The National Sleep Societies

## SLOVENIA



### Slovene Sleep Society Slovenska Skupina za spanje



Current President: Leja Dolenc, MD, PhD

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<b>Foundation year</b>	2005
<b>Webpage</b>	<a href="http://www.kclj.si/ikn/">http://www.kclj.si/ikn/</a>
<b>Number of members</b>	30
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	40% Neurologists, 20% Pneumologists, 10% Pediatricians, 10% Psychiatrists, 10% Clinical Psychologists, 5% ENT, 5% Neuroradiologists
<b>Historical perspective of the society</b>	The society was founded in Ljubljana in 2005 with the aim of integrating sleep research and sleep medicine in different medical fields. Since then, Sleep Medicine and its diagnostic procedures became recognized by Health Authorities in Slovenia.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Leja Dolenc Grošelj, Barbara Gnidovec Stražičar, Matjaž Fležar, Jasmina Gabrijelčič, Igor Fajdiga
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	3 <a href="http://www.kclj.si/ikn/">http://www.kclj.si/ikn/</a> <a href="http://pednevro.pedkl.si/">http://pednevro.pedkl.si/</a> <a href="http://www.klinika-golnik.si/">http://www.klinika-golnik.si/</a>
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	3 <a href="http://www.kclj.si/ikn/">http://www.kclj.si/ikn/</a> <a href="http://pednevro.pedkl.si/">http://pednevro.pedkl.si/</a> <a href="http://www.klinika-golnik.si/">http://www.klinika-golnik.si/</a>
<b>Accreditation / Certification procedure</b>	None at present.
<b>Educational programs</b>	<ul style="list-style-type: none"><li>- Sleep Medicine is the part of teaching program at the Medical Faculty, University of Ljubljana.</li><li>- Sleep Medicine is included in different postgraduate courses for neurologists, psychiatrists, and pediatricians (from 1 week to 6 months)</li><li>- Continuing education for sleep technologists (6 months)</li><li>- Continuing education in sleep medicine for MD (as part of 6 months EEG course)</li><li>- Short educational courses are organized for general doctors</li><li>- Sleep Medicine is part of the PhD program at the Medical Faculty.</li></ul>
<b>Present activities, working groups, task forces</b>	<ul style="list-style-type: none"><li>- "Sleep January": Annual Sleep congress with workshops, keynote lectures and oral presentations organized by Slovene Sleep Society.</li><li>- Every year's students research award ("Prešern award")</li><li>- Providing guidelines for the assessment of the ability to drive in patients with sleep disorders.</li><li>- Providing guidelines for general doctors regarding referrals to sleep centers.</li></ul>
<b>Miscellaneous</b>	Numerous different activities are organised by the Sleep Society; e.g. World sleep day and European Narcolepsy day.

# The National Sleep Societies

## SPAIN



### Sociedad Española de Sueño (SES) Spanish Sleep Society (SSS)



Current President: D. Garcia-Borreguero, MD

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<b>Foundation year</b>	1991
<b>Webpage</b>	<a href="http://www.sesueno.es">www.sesueno.es</a>
<b>Number of members</b>	340
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	Clinical Neurophysiology (40%), Respiratory (15%), Pediatrics (6%), Neurology (5%), Psychiatry (4%), Orthodontics (4%), Basic Research (6%), Other (20%).
<b>Historical perspective of the society</b>	<p>The SES (initially named AIPS) was founded in 1991 and has organized so far 21 Annual Meetings in Spain. The celebration of the XIV European Congress of the European Sleep Research Society (ESRS) (September 1998, Madrid) and the upcoming 5<sup>th</sup> World Congress on Sleep Medicine (September 2013, Valencia) organized by the World Association of Sleep Medicine (WASM) and the Spanish Sleep Society (SES), reflect the international projection of our society and its members.</p> <p>Our society has become the main reference in Sleep Medicine in Spain and has grown vigorously over the last years, with the incorporation of different specialties (pediatricians, pulmonologists, general practitioners, clinical neurophysiologists, neurologists, etc.).</p>
<b>Important sleep physicians / researchers in the history of the NSS</b>	<p>Clinical research (alphabetically): F. Barbe, J. Durán, D. Garcia-Borreguero, A. Iranzo, F. Masa, J. Montserrat, J. Nieto, R. Peraita, J. Puertas, T. Quera-Salva, J. Terán, T. Sagalés, J. Santamaria, A. Vela.</p> <p>Basic research (alphabetically): M. Barbanoj, I. de Andrés, M. Garzón, J. Gaztelu, F. Reinoso-Suarez, R. Rial.</p>
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	32 (see <a href="http://www.sesueno.org/ceams">www.sesueno.org/ceams</a> )
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	5
<b>Accreditation / Certification procedure</b>	<p>Comité Español de Acreditación en Medicina del Sueño (CEAMS): Multidisciplinary Accreditation endorsed by the main scientific societies in Spain (Respiratory, Neurology, Psychiatry, Pediatrics) under the umbrella of the Spanish Sleep Society:</p> <ul style="list-style-type: none"><li>- Accreditation of Sleep Medicine Centers</li><li>- Accreditation of Professionals in Sleep Medicine</li></ul>
<b>Educational programs</b>	<p>Master in Neuroscience in Sleep (Universidad Autónoma, Madrid), Master in Sleep Medicine (Pablo Olavide University, Sevilla), Advanced multidisciplinary Courses: Burgos, Lleida (Hot-Topics in Sleep Apnea) Spanish Society of Neurology (Monasterio de los Avellanes, Lleida).</p>

# The National Sleep Societies

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**Present activities,  
working groups, task  
forces**

5<sup>th</sup> World Congress on Sleep Medicine (Valencia, Sept 28 – Oct 3, 2013).

Diagnostic and therapeutic guidelines:

- Guidelines in OSA: GrupoEspañol de Sueño. Consenso nacional sobre el síndrome de apneas-hipopneas del sueño. Arch Bronconeumol, 2005; 41(Suppl 4):1-110 (Spanish).
- Guidelines in pediatric OSA: Alonso-Álvarez ML et al. Arch Bronconeumol. 2011;47(Suppl 5):2-18 (Spanish).
- Standards and Recommendations for Sleep Units, carried out in the Quality Agency of the spanish Ministry of Health.
- Guidelines for diagnosis and treatment of Restless Legs Syndrome (Spanish Sleep Society and Spanish Neurological Society).

**Miscellaneous**

Journal VIGILIA-SUEÑO (since 1991)

# The National Sleep Societies

## SWEDEN



### Svensk Förening för Sömnforskning och Sömnmedicin (SFSS) Swedish Sleep Society



Current President: Dr. Lena Leissner

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<b>Foundation year</b>	1989
<b>Webpage</b>	<a href="http://www.swedishsleepresearch.com">http://www.swedishsleepresearch.com</a>
<b>Number of members</b>	498
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	40% physicians mainly ENT specialists and Pneumologists and a few Neurologists, Psychiatrists, GPs, Pediatricians, Gynaecologists and Neurophysiologists. 20% Nurses, 15% Dentists, 13% Technicians, 5% Psychologists and 2% Physiotherapists; 5% other.
<b>Historical perspective of the society</b>	The society was founded in 1989. The aim of the society is to promote basic and clinical research as well as clinical activity concerning sleep and wakefulness. It started with a very small group of people working in sleep research and the first president was Prof. Jerker Hetta. During the years the society has grown, not only in members but also in the field of interest. Both sleep research and sleep medicine has widened and today we are proud of recognizing many different professions coming together sharing their common interest of sleep.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Torbjörn Åkerstedt, Jerker Hetta, Eva Svanborg, Jan Hedner, Ludger Grote, Yüksel Peker, Jan Ulfberg, Eva Lindberg, Karl Franklin and Sören Berg.
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	A total of 11 centers provide full PSG services on a regular basis, additional 25 centers provide mainly diagnosis and treatment of sleep disordered breathing <a href="http://www.swedishsleepresearch.com/somnlab">http://www.swedishsleepresearch.com/somnlab</a>
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	A total of 15 centers report ongoing research projects at the SFSS webpage, at our annual meetings and at international congresses. <a href="http://www.swedishsleepresearch.com/somnlab">http://www.swedishsleepresearch.com/somnlab</a>
<b>Accreditation / Certification procedure</b>	The society provides, as part of the Nordic Association of Sleep Research and Sleep Medicine Societies (NOSMAC), a certificate in Sleep Medicine in accordance with the ESRS certification guidelines. The candidates must also pass four training courses (sleep physiology, breathing disorders during sleep, insomnia, para- and hypersomnias) provided by the society. This education is mainly adjusted to physicians but there is a similar, but less extensive program for other groups. 27 "grandfathers/-mothers" have been certified and trained. The accreditation process for sleep centers within the NOSMAC organization is outlined and this process will start in the very near future.
<b>Educational programs</b>	Besides the courses included in the specialist training program, the society also organizes workshops and courses at the annual congresses and sometimes also at other specialists joint meetings.
<b>Present activities, working groups, task forces</b>	We have an annual congress consisting of one day with courses/workshops and two days of science with keynote lectures and oral and poster presentations. During the last years we have built up three sections within the society; the Odontological-, the Pediatric- and the Behavioral Sleep Medicine to accomplish further development within these groups. Members of the society take great responsibility in highlighting sleep issues in the scientific and clinical world but also in the community, among ordinary people, politicians and leaders as well as in schools and industries by giving lectures, interviews or in other ways sharing expert knowledge.

# The National Sleep Societies

## SWITZERLAND



Schweizerische Gesellschaft für Schlafforschung,  
Schlafmedizin und Chronobiologie  
Société Suisse de Recherche sur le Sommeil,  
de Médecine du Sommeil et de Chronobiologie  
Swiss Society for Sleep Research, Sleep Medicine and Chronobiology



Current President: Prof. Dr. Peter Achermann

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<b>Foundation year</b>	1991
<b>Webpage</b>	<a href="http://www.swiss-sleep.ch/">http://www.swiss-sleep.ch/</a>
<b>Number of members</b>	301
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	44 % Pneumologists, 20% Neurologists, 10% PhDs, 7% Psychiatrists, 4% Pediatricians, and 15% various specialties.
<b>Historical perspective of the society</b>	The society was founded in Zurich in 1991 with the aim of integrating sleep research, sleep medicine and chronobiology. Its first president was Prof. A. Borbély. In 1997, the society received a mandate from the Ministry of Health to formulate conditions and procedures for the accreditation of sleep centers. Since then, the society has accredited 30 sleep centers whose services are recognized by health insurance companies.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Clinical research: Michel Gaillard, Christian W. Hess, Konrad Bloch, Mathias Guggler, Johannes Mathis and Claudio Bassetti. Basic research: Alexander Borbély, Anna Wirz-Justice, Irene Tobler, Peter Achermann and Mehdi Tafti.
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	30 For a complete list see: <a href="http://swiss-sleep.ch/dokumente/Centers.pdf">http://swiss-sleep.ch/dokumente/Centers.pdf</a>
<b>Number of Sleep Research Centers</b>	6
<b>Accreditation / Certification procedure</b>	Our society provides a <b>certificate in sleep medicine</b> for MDs with a specialization in Pneumology, Psychiatry or Neurology. In order to receive the certification, MDs must have worked in an accredited sleep center in Switzerland or abroad for at least 6 months, have diagnosed and worked with a minimal number of individuals with sleep disorders, and have conducted and assessed a certain number of polysomnographies, MSLTs, MWTs, actigraphies, respiratory polygraphies and oxymetries. MDs from other disciplines require an additional 2 years of sleep education. A similar procedure exists for PhDs and psychologists, but in addition they must pass the examination of the German Sleep Society for Somnologists. <b>Sleep centers are accredited</b> if they can assure an interdisciplinary team including at least a pneumologist, a psychiatrist, and a neurologist. The head of this team must have received a minimum of two years of training in sleep medicine and received a certificate in sleep medicine. Consultants must provide an education comparable to the certificate in sleep medicine. In addition, technicians, rooms and equipment of the sleep laboratory must also meet certain criteria.
<b>Educational programs</b>	Workshops for continuing education are organized at the annual meetings. Credits for continuing education are also provided.
<b>Present activities, working groups, task forces</b>	We have an annual scientific meeting with workshops, keynote lectures, oral and poster presentations. Approximately every 2 <sup>nd</sup> year we hold the meeting in conjunction with another society. Committees of experts convene to perform a variety of functions including: awarding certification in sleep medicine, accreditation and re-accreditation of Sleep Centers, awarding prizes and travel grants, reimbursement practice of oral appliances, ensuring recognition of our certification by the Swiss Medical Association, and providing guidelines for the assessment of the ability to drive in patients with sleep disorders.

# The National Sleep Societies

## TURKEY



### Turk Uyku Tıbbi Dernegi (TUTD) Turkish Sleep Medicine Society (TSMS)



Current President: Dr. Derya Karadeniz

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<b>Foundation year</b>	1992
<b>Webpage</b>	<a href="http://www.tutd.org.tr">www.tutd.org.tr</a>
<b>Number of members</b>	919
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	The society has 3 groups of membership as main, complimentary and honoric. The main members include both academic and clinical specialists. Main members are medical doctors mainly from neurology, pulmonology, ENT disorders, psychiatry, physiology, cardiology, anesthesiology, internal medicine and pediatrics. Complimentary members include sleep technicians, psychologists, engineers or dentists.
<b>Historical perspective of the society</b>	The society was established in 1992 entitled as "Sleep Research Society", and later renamed by the Council of Minister as "Turkish Sleep Research Society". In 2007, the name of the society was changed into "Turkish Sleep Medicine Society" (TSMS) by the general assembly. The first scientific meeting of the society was held in 1992, later continued as national congresses. National congresses were performed once in two years till 2006, and later yearly. The 15 <sup>th</sup> European Sleep Research Society Congress which was held in Istanbul 12 – 16 September 2000 was hosted by the TSMS.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Prof. Dr. Ismet Karacan, Prof. Dr. Sevket Akpınar Past Presidents: Erbil Gözükırmızı, Hakan Kaynak, Sadık Ardıc, Derya Karadeniz
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	31 (See: <a href="http://www.tutd.org.tr">www.tutd.org.tr</a> )
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	12 (See: <a href="http://www.tutd.org.tr">www.tutd.org.tr</a> )
<b>Accreditation / Certification procedure</b>	ESRS accreditation criteria has being used for the certification of sleep centers/laboratories. These centers/laboratories are being re-supervised every five years and re-accredited as they continue to perform sleep studies on the basis of international criteria. TSMS has organized Sleep Medicine Courses of 5 days for medical doctors since 1998. After 2006, Practical Education and Certification Program in an accredited sleep center by TSMS was added to this theoretical education. TSMS Qualification Board was established in 2010 to organize an educational program for sleep medicine, and is still continuing its tasks in collaboration with the Directory Board of TSMS. Upon completing the Sleep Medicine Courses of 5 days which are held every year and Certification Program and Practical Education for 6 months a "Sleep Medicine Certificate" is given to medical doctors. A certification program was established in 2010 for sleep technicians who had adequate practical experience and succeeded the examination following certification program.

# The National Sleep Societies

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<b>Educational programs</b>	<p>In addition to annually organized National Sleep Medicine Congresses, local scientific meetings have been organized yearly.</p> <p>Prof. Dr. Sevket Akpınar's Symposium was held in Ankara, on 14<sup>th</sup> May, 2011 for the first time. It will continue to be held every year. Since 2011 TSMS has been organizing scientific meetings every year on March 16 to celebrate the 'World Sleep Day'.</p>
<b>Present activities, working groups, task forces</b>	<p>'Technician Study Group' was established in 2008. Educational program for sleep technicians has been organized yearly together with the National Sleep Medicine Congress.</p> <p>'Basic sciences', 'Scientific research', 'Sleep and occupation', 'Pediatric Sleep' and 'Surgery in Sleep Medicine' study groups were established in 2011.</p> <p>The Turkish Ministry of Health published regulations on education with certification in 2010. Upon this, TSMS applied for "Sleep Medicine Physicians Certification Program" and "Sleep Technicians Certification Program" to be approved by the Ministry of Health nationwide.</p>
<b>Miscellaneous</b>	<p>TSMS published booklets or brochures for medical doctors dealing with sleep medicine or other branches.</p> <p>TSMS Bulletin is being published twice in a year since 2006.</p> <p>Educational booklets for the patients and the community have been published, including 'What is healthy sleep?', 'Insomnia', 'Sleep apnea syndrome', 'Parasomnias', 'Restless legs syndrome', and 'Excessive daytime sleepiness'.</p> <p>The copyrights for "The AASM Manual for the Scoring of Sleep and Associated Events: Rules, Terminology and Technical Specifications" was bought by TSMS and its Turkish translation was published in 2008.</p> <p>In 2010, a book entitled 'Physiology of Sleep and Its Disorders' was published in Turkish to present basic physiology and disorders of sleep for physicians.</p> <p>Finally, TSMS has bought the copyrights for "International Classification of Sleep Disorders (ICSD) II" for physicians and "Essentials of Sleep Technology" for sleep technicians.</p> <p>TSMS conducted a nationwide epidemiological study all over the Turkey with 5000 participants in 2009, which was sponsored by Cephalon Europe and Gen Medicine. The first phase of the "Epidemiology of Turkish Sleep Disorder Study" was completed in 2010 and results were submitted for publication. The second phase of the study involving polysomnographic investigations is ongoing.</p>

# The National Sleep Societies

## UNITED KINGDOM



### The British Sleep Society (BSS)



Current President: Prof. Paul Reading

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<b>Foundation year</b>	1989
<b>Webpage</b>	<a href="http://www.sleeping.org.uk">www.sleeping.org.uk</a>
<b>Number of members</b>	389
<b>Composition of members (degree, specialties, subspecialties, etc.)</b>	The society has an inclusive approach to all specialists related to sleep medicine and sleep research. The members include both academic and clinical specialists, particularly neurologists, pulmonologists, psychiatrists, psychologists, pediatricians, geriatricians as well as neurophysiologists, circadian rhythm experts, nurses and a large number technologists working in sleep laboratories.
<b>Historical perspective of the society</b>	The society was founded in 1989 mainly in response to the increase of awareness of obstructive sleep apneas and their clinical importance. Over the next few years it broadened to include neurological and physiological interests with strong emphasis on technical aspects and polysomnography. Over the last 10 years special interest groups in, for instance, pediatrics and techniques, such as actigraphy, have been established so that it now provides a comprehensive resource to clinical, research and technical specialties.
<b>Important sleep physicians / researchers in the history of the NSS</b>	Past Presidents and Chairmen 1989 – 1990 N. Douglas and C. Shapiro 1990 – 1991 I. Hindmarch 1991 – 1992 J. Stradling 1992 – 1993 C. D. Hanning 1993 – 1996 W. McNicholas 1996 – 1998 C. Idzikowski 1998 – 2001 P. Calverley 2001 – 2003 Neil Stanley 2004 – 2008 Melissa Hack 2008 – 2011 John Shneerson 2011 – Paul Reading
<b>Number of Sleep Medicine Centers (link to their titles and locations)</b>	<a href="http://www.sleeping.org.uk/sleepmap.aspx">http://www.sleeping.org.uk/sleepmap.aspx</a>
<b>Number of Sleep Research Centers (link to their titles and locations)</b>	These include the Respiratory Support & Sleep Centre, Papworth Hospital, Cambridge Glasgow Sleep Center University of Surrey St Thomas's Hospital, London Elvina Hospital, London, Burden Centre, Bristol, Tom MacKay's Edinburgh University of Edingborough Loughborough University, Russell Foster's Oxford Mike Hastings in Cambridge regarding circadian rhythms

# The National Sleep Societies

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**Accreditation /  
Certification procedure**

The Society has formalized an Accreditation procedure for sleep centres providing polysomnography in harmony with the ESRS recommendations.

The first centre to be approved was the Respiratory Support & Sleep Centre, Papworth Hospital, Cambridge in 2011.

**Educational programs**

The Society has for many years ran an Annual Scientific meeting each September which has been held in Cambridge since 2001. The Society also holds an annual Spring Technologist Conference at different locations around the country each year. Both of these meetings have proved popular with excellent feedback. In addition the Society has joined with the Belgian and Dutch Sleep Societies to co-organise the International Sleep Medicine Course (ISMC) and host this important meeting every 3 years.

**Present activities,  
working groups, task  
forces**

The Society has a main Executive Committee with subcommittees such as the Accreditation Committee and Scientific Meeting Committee

In addition to the Accreditation procedure for sleep medicine centres it has recently developed position statements such as on the use of Modafinil for conditions other than narcolepsy causing excessive daytime sleepiness and regarding increasing the awareness and providing treatment for Heavy goods vehicle (HGV) drivers with obstructive sleep apnoeas.

The society's working with other medical specialist bodies to promote sleep medicine as a medical sub-specialty in the UK.

# Index of Authors

Åkerstedt, Torbjörn . . . . .	55
Amici, Roberto . . . . .	23
Bassetti, Claudio L. . . . .	7, 27, 61
Batini, Cesira . . . . .	71
Baumann, Christian R. . . . .	61
Billiard, Michel . . . . .	15
Borbély, Alexander A. . . . .	23
Bruni, Oliviero . . . . .	49
Cirignotta, Fabio . . . . .	75
Dijk, Derk-Jan . . . . .	7, 17, 37
Dogas, Zoran . . . . .	7
Espie, Colin . . . . .	33
Ferini-Strambi, Luigi . . . . .	27
Franken, Paul . . . . .	43
Gottesmann, Claude . . . . .	63
Hedner, Jan . . . . .	35
Hess, Christian W. . . . .	67
Horne, Jim . . . . .	17, 19
Kecklund, Göran . . . . .	55
Kerkhofs, Myriam . . . . .	69
Khatami, Ramin . . . . .	61
Kovalzon, Vladimir M. . . . .	59
Lavie, Peretz . . . . .	17
Levy, Patrick . . . . .	7, 35
Luppi, Pierre-Hervé . . . . .	65
Maquet, Pierre . . . . .	51
Nobili, Luigi Lino . . . . .	7
Parmeggiani, Pier Luigi . . . . .	23
Partinen, Markku . . . . .	57
Peigneux, Philippe . . . . .	7, 23, 51
Penzel, Thomas . . . . .	53, 73
Pevernagie, Dirk . . . . .	53, 69
Pollmächer, Thomas. . . . .	7, 13, 31
Riemann, Dieter . . . . .	7, 33
Salzarulo, Piero . . . . .	9, 47
Santamaria, Joan . . . . .	27
Schredl, Michael . . . . .	41
Schulz, Hartmut . . . . .	9, 19
Schwartz, Sophie . . . . .	41
Skene, Debra J. . . . .	7, 37
Tafti, Mehdi . . . . .	43
Tobler, Irene . . . . .	39
Wirz-Justice, Anna . . . . .	37



# Index

## A

accreditation . . . 7, 8, 9, 10, 53, 54, 74, 85,  
86, 89, 90, 91, 92, 93, 94, 95, 96, 98, 99,  
101, 102, 107, 109, 110, 111, 112, 114,  
119, 120, 121  
Achermann, Peter . . . 5, 81, 120  
activating reticular system . . . 71  
adenosine . . . 21, 59  
Adrian, E.D. . . . 71  
Adrien, Joëlle . . . 17, 22, 31, 47, 82, 94  
advanced sleep phase disorder . . . 37  
ageing . . . see aging  
aging . . . 47, 48, 51, 56  
agrypnia . . . 28  
Åkerstedt, Torbjörn . . . 4, 9, 10, 13, 16, 17,  
18, 19, 33, 37, 55, 58, 78, 119  
Akert, Konrad . . . 9, 67, 68  
Akpinar, Sevket . . . 121, 122  
Alzheimer's disease . . . 28, 38, 51  
Amici, Roberto . . . 3, 12, 23, 79, 81, 104  
Amzica, Florin . . . 113  
antidepressants . . . 31  
Aschoff, Jürgen . . . 37, 80  
Aserinsky, Eugene . . . 9, 41, 113  
Assembly of National Sleep Societies  
(ANSS) . . . 10, 11, 14, 15, 98  
Austria . . . 83  
autoimmune disorders . . . 29, 62  
automated analyses . . . 31

## B

Barbe, F. . . . 117  
basal ganglia . . . 61, 62  
Bassetti, Claudio L. . . . 2, 3, 4, 5, 7, 10, 11,  
14, 16, 17, 18, 27, 28, 58, 61, 68, 79, 80,  
82, 120  
Batini, Cesira . . . 4, 71, 72  
Baumann, Christian R. . . . 4, 61  
Beersma, Domien . . . 37, 80, 81, 107  
behaviour . . . 18, 22, 23, 29, 39, 42, 47, 49,  
63, 65, 67, 68, 71  
Belgium . . . 84  
Berger, Hans . . . 27, 31, 73  
Berger, Mathias . . . 42, 73, 79, 96  
Bertini, Mario . . . 16, 19, 33, 75, 104  
Billiard, Michel . . . 3, 14, 15, 16, 33, 57, 58,  
80, 94, 98  
birds . . . 39, 65, 66, 115  
Bjorvatn, B. . . . 58, 109  
blind . . . 38, 42  
body temperature . . . 13, 63  
Bonnet, Michael . . . 18  
Borbély, Alexander A. . . . 3, 9, 10, 11, 13,  
14, 16, 17, 19, 20, 21, 23, 31, 37, 39, 51,  
68, 77, 78, 80, 81, 120  
Born, Jan . . . 18, 51  
Bosinelli, Marino . . . 33, 41, 75, 104  
brain activation . . . 41  
Bremer, Frédéric . . . 4, 23, 27, 65, 67, 69,  
70, 71  
Bruni, Oliviero . . . 3, 49  
Bulgaria . . . 86  
business meeting . . . 9, 12, 15

## C

Cajochen, Christian . . . 18, 19, 81  
cataplexy . . . 28, 50, 62  
cats . . . 20, 21, 39, 41, 65, 66, 67, 68, 69, 70

*C. elegans* . . . 43  
central apneas . . . 35  
cerebrospinal fluid . . . 63  
certification . . . 8, 10, 53, 54, 74, 89, 93,  
102, 110, 114, 119, 120, 121, 122  
cerveau isolé . . . 65, 69, 71  
Challamel, Marie-Jo . . . 47, 49, 94  
Cheyne-Stokes respiration . . . 35  
childhood . . . 49, 50  
cholinergic . . . 23, 28, 31, 65  
chronobiology . . . 3, 7, 31, 37, 38, 95, 97,  
108, 120  
Cipolli, Carlo . . . 41, 42, 75, 104  
circadian clock . . . 37, 38, 43, 45  
circadian rhythm . . . 19, 31, 33, 37, 38, 43,  
47, 123  
circadian system . . . 24, 37  
Cirelli, Chiara . . . 24, 37, 39, 43, 78  
Cirignotta, Fabio . . . 22, 75, 102  
Claparède, E. . . . 24, 57  
clock genes . . . 37, 43, 45  
cognition . . . 23, 33, 47, 58  
cognitive behavioural treatment . . . 31  
CPAP . . . 28, 35, 36, 85, 92  
Croatia . . . 88  
Cushing, H. . . . 69  
cyclic alternating pattern . . . 75, 76  
Czech Republic . . . 90  
Czeisler, Charles A. . . . 37, 80, 81

## D

Daan, Serge . . . 31, 37, 80, 81  
de Boer, Tom . . . 18, 107  
de Gennaro, Luigi . . . 18  
dementia . . . 9, 27, 28, 47  
Denmark . . . 91  
depression . . . 31, 38, 44, 58, 107  
de Saint Denys, Hervey . . . 51  
Dijk, Derk-Jan . . . 3, 7, 17, 18, 19, 37, 43,  
79, 81, 82  
Dogas, Zoran . . . 3, 7, 88, 89  
dogs . . . 43, 59, 63  
dolphins . . . 39, 60  
Douglas, Neil . . . 35, 58, 123  
dream . . . 3, 15, 27, 41, 42, 51, 65, 66, 97,  
104, 108  
dream recall . . . 41, 42  
Dreyfus-Brisac, Colette . . . 47, 48, 49  
Drosophila . . . 37, 39, 43  
Dukes, Clement . . . 57

## E

eating disorders . . . 42  
EEG . . . 7, 13, 19, 20, 21, 24, 25, 27, 28, 31,  
37, 39, 41, 42, 43, 44, 45, 47, 48, 49, 51,  
60, 65, 66, 68, 69, 71, 73, 76, 88, 104,  
115, 116  
EEG slow-wave activity . . . 24, 39  
EEG spectra . . . 19  
EEG trait . . . 43  
sleep EEG . . . 43  
Ekblom, K. A. . . . 28  
enacted dreams . . . 42  
encéphale isolé . . . 69, 70  
encephalitis . . . 29, 61, 62, 67  
encephalitis lethargica . . . 29, 61, 62  
epidemiology . . . 27, 35, 57, 58, 75, 76, 122

epilepsy . . . 13, 22, 28, 29, 71, 75, 76, 115  
nocturnal frontal lobe epilepsy . . . 28, 75,  
76  
ergotropic . . . 24, 67, 68  
ESADA . . . 36  
Espie, Colin . . . 3, 16, 18, 31, 33, 80  
ESRS bylaws . . . 10, 13  
ESRS meetings . . . 10, 11, 33, 35  
ESRS newsletter . . . 11, 17, 53  
Estonia . . . 92  
European Network of Sleep Laboratories  
(ENSTL) . . . 11  
European Respiratory Society (ERS) . . . 11,  
14, 101  
European Sleep Science Award . . . 10

## F

Fagioli, Igino . . . 49, 75, 78, 104, 105  
Ferini-Strambi, Luigi . . . 3, 27, 28, 57, 102  
Finland . . . 93  
fMRI . . . 19, 23, 24  
forbidden zone . . . 20  
forced desynchrony . . . 37  
Foulkes, David . . . 41  
France . . . 94  
Franck, Georges . . . 84  
Franken, Paul . . . 3, 37, 43, 44, 81  
Freud, Sigmund . . . 51  
functional brain imaging . . . 23  
functional magnetic resonance imaging . . .  
19, 23  
Füssli, Heinz Johann . . . 27

## G

GABA . . . 59  
Gaillard, Jean-Michel . . . 31, 68, 78, 120  
Garcia-Borreguero, Diego . . . 79, 117  
Gastaut, Henri . . . 27, 28, 35, 57, 75  
Gélinau, E. B. . . . 27  
genetics . . . 7, 8, 27, 33, 38, 43, 44  
genome-wide association (GWA) . . . 44  
Germany . . . 96  
Gillin, Christian . . . 17, 79  
glutamatergic . . . 23  
Golgi, C. . . . 71  
Gonçalves, Marta . . . 111  
Gottesmann, Claude . . . 4, 9, 15, 31, 63, 94  
Grashchenkov, Nikolay I. . . . 60, 114  
Greece . . . 98  
Grote, Ludger . . . 5, 58, 73, 79, 119  
Gugger, Mathias . . . 120  
Guilleminault, Christian . . . 49, 57, 58, 75

## H

Halász, Péter . . . 99  
hallucinations . . . 27  
Hedner, Jan . . . 3, 18, 35, 58, 119  
herbivores . . . 39  
Hess, Christian W. . . . 67, 120  
Hess, Walter Rudolf . . . 4, 9, 10, 13, 23, 24,  
62, 67, 68, 71, 80  
hibernation . . . 39  
high-density EEG . . . 24  
Högl, Birgit . . . 16, 27, 79, 83, 96  
homeostasis . . . 19, 21, 24, 25, 37, 39, 43,  
44, 45, 51, 76  
Horne, Jim . . . 3, 5, 11, 13, 17, 18, 19, 33,  
57, 77, 81

- Hungary . . . . 99  
 hypersomnias . . . . 14, 27, 58, 119  
 hypertension . . . . 35, 58  
 hypnotics . . . . 31  
 hypocretin . . . . 7, 27, 43, 44, 62  
 hypothalamus . . . . 4, 23, 61, 62, 68, 69, 71  
 hypoxic models . . . . 35
- I**  
 Iceland . . . . 100  
 infancy . . . . 22, 42, 49  
 inflammatory mechanisms . . . . 35  
 influenza . . . . 27, 50, 62, 101  
 insomnia . . . . 7, 8, 11, 15, 27, 28, 29, 31, 33, 38, 42, 50, 55, 56, 57, 58, 61, 65, 67, 68, 75, 76, 86, 87, 95, 97, 106, 108, 112, 115, 119, 122  
 instinctive behaviours . . . . 71  
 invertebrates . . . . 14, 25, 39, 63  
 Ireland . . . . 101  
 Ishimori, K. . . . . 59, 63  
 Italy . . . . 102, 104
- J**  
 Journal of Sleep Research (JSR) . . . . 3, 5, 7, 10, 11, 13, 15, 17, 18, 33, 37, 57  
 Jouvet, Michel . . . . 4, 9, 10, 15, 17, 23, 27, 31, 39, 41, 47, 51, 60, 65, 66, 77, 94, 113  
 Jovanović, Uroš J. . . . . 9, 15, 31, 41, 96  
 Jung, Richard . . . . 4, 28, 73
- K**  
 Kahn, André . . . . 47, 49, 84  
 Karacan, Ismet . . . . 60, 121  
 Kaye, Khalil . . . . 109  
 Kecklund, Göran . . . . 4, 55  
 Kerkhofs, Myriam . . . . 4, 12, 16, 69, 79, 81, 84  
 Khatami, Ramin . . . . 4, 61, 67  
 Kleitman, Nathaniel . . . . 9, 37, 41, 59, 63, 67, 113  
 Knobl, Brigitte . . . . 2, 5, 18  
 knock-out . . . . 43  
 Koella, Werner P. . . . . 9, 10, 11, 13, 15, 16, 57, 68, 77  
 Kogan, Aleksandr B. . . . . 60, 114  
 Kovalzon, Vladimir M. . . . . 4, 59, 60, 114, 115  
 Kraepelin, Emil . . . . 31  
 Kramer, Milton . . . . 41  
 Krieger, Jean . . . . 9, 35, 94  
 Krueger, James . . . . 37, 78  
 Kuhlo, Wolfgang . . . . 4, 28, 35, 73, 96  
 Kupfer, David J. . . . . 31  
 Kurtz, Daniel . . . . 16, 35, 78, 94
- L**  
 Lavie, Peretz . . . . 3, 10, 16, 17, 18, 20, 33, 35, 57, 69, 77, 80, 81  
 learning . . . . 19, 28, 33, 44, 51, 52, 71, 113  
 Leger, Damien . . . . 18, 95  
 Levin, P. . . . . 9  
 levodopa . . . . 28  
 Levy, Patrick . . . . 3, 11, 18, 35, 95  
 Lewy bodies . . . . 27, 28  
 light . . . . 15, 17, 19, 20, 31, 33, 37, 38, 42, 49, 66, 70, 107, 108  
 light therapy . . . . 31, 38, 107, 108
- Lithuania . . . . 106  
 local sleep . . . . 37, 75  
 lucid dreaming . . . . 41, 42  
 Lugaresi, Elio . . . . 4, 10, 22, 28, 35, 57, 58, 75, 102  
 Luppi, Pierre-Hervé . . . . 4, 18, 65, 66, 94
- M**  
 magnetoencephalography . . . . 24  
 Magoun, Horace W. . . . . 9, 65, 67, 69, 71, 75  
 mammals . . . . 24, 39, 63, 66, 69, 115  
 Manasseina-Korkunova, Maria Mikhailovna . . . . 4, 59  
 Mancina, Mauro . . . . 75, 104  
 Maquet, Pierre . . . . 3, 11, 18, 19, 23, 41, 51  
 Marie Curie program . . . . 12, 14, 71, 81, 82, 94, 95  
 Marshall, Nathaniel . . . . 18  
 Mathis, Johannes . . . . 120  
 McNicholas, W. . . . . 101, 123  
 Meier-Ewert, K.-H. . . . . 73, 96  
 melanopsin . . . . 37, 38  
 melatonin . . . . 20, 37, 38, 50  
 memory . . . . 3, 19, 28, 41, 42, 44, 48, 51, 52, 71, 115  
   memory consolidation . . . . 42, 51, 52  
 mental disorders . . . . 31, 33  
 MESAM . . . . 73  
 mesencephalic transection . . . . 69  
 metabolic disorders . . . . 35, 36  
 mice . . . . 21, 22, 37, 39, 43, 44, 45, 66  
 modafinil . . . . 66, 124  
 molecular processes . . . . 25  
 Monnier, Marcel . . . . 9, 68  
 monoaminergic . . . . 23  
   monoaminergic theory . . . . 65  
   monoamines . . . . 65  
 monoamines . . . . 65  
 Monod, Nicole . . . . 47, 49  
 Montserrat, J. . . . . 117  
 mood disorders . . . . 22, 50  
 Moruzzi, Giuseppe . . . . 4, 9, 23, 27, 67, 71, 72, 75  
 Morvan . . . . 27, 28  
 Mukhametov, Lev M. . . . . 39, 60, 115  
 multiple sclerosis . . . . 29  
 multi-unit activity . . . . 39  
 muscle atonia . . . . 41, 65, 66  
 music . . . . 15, 42
- N**  
 nap . . . . 31, 37  
 narcolepsy . . . . 7, 11, 13, 14, 15, 27, 28, 29, 33, 42, 43, 44, 45, 49, 50, 57, 58, 62, 66, 76, 89, 90, 98, 101, 106, 108, 109, 116, 124  
 National Sleep Societies . . . . 4, 5, 10, 11, 14, 15, 84, 98  
 neurochemical . . . . 23  
 neurology . . . . 3, 7, 8, 14, 15, 27, 49, 61, 69, 73, 74, 75, 83, 86, 87, 90, 91, 96, 97, 98, 102, 106, 109, 113, 115, 117, 120, 121  
 neurophysiological . . . . 7, 23, 24, 27, 28, 41, 42, 51, 65, 71, 73, 115  
 neuroscience . . . . 3, 7, 8, 23, 41, 51, 55, 65, 68, 72, 88, 104, 111, 113, 117  
 newborns . . . . 48, 49  
 newsletter . . . . 11, 17  
 nightmare . . . . 15, 27, 41, 42
- nitric oxide . . . . 21  
 Nobili, Luigi Lino . . . . 3, 5, 7, 28  
 Norway . . . . 109  
 NREM dreaming . . . . 41  
 NREM sleep . . . . 19, 21, 27, 28, 42, 51, 76  
 NSS . . . . see National Sleep Societies
- O**  
 Obál, Ferenc . . . . 37, 82, 99  
 obesity . . . . 22, 33, 35, 38, 50, 57, 113  
 oneiric behaviours . . . . 65  
 Oniani, Tengiz N. . . . . 60, 77, 114  
 ontogeny . . . . 66  
 optogenetic . . . . 23  
 orexin . . . . 27, 43, 62  
 Oswald, Ian . . . . 9, 13, 15, 16, 31, 57, 60  
 oxidative stress . . . . 35
- P**  
 Paiva, Teresa . . . . 12, 16, 42, 78, 111  
 paradoxical sleep . . . . 9, 39, 41, 47, 51, 52, 65, 66, 68, 113  
 parasomnia . . . . 27, 57, 75, 95  
 Parkes, David . . . . 10, 17, 77  
 Parkinson's disease . . . . 28, 62  
 Parmeggiani, Pier Luigi . . . . 3, 11, 13, 16, 17, 20, 21, 23, 75, 77, 80, 104  
 Partinen, Markku . . . . 4, 16, 17, 57, 58, 77, 93  
 Passouant, Pierre . . . . 13, 15, 16, 31, 47, 57, 94  
 Pavlov, Ivan . . . . 4, 59, 60, 71  
 Peigneux, Philippe . . . . 3, 7, 19, 23, 51, 79  
 Penzel, Thomas . . . . 3, 4, 53, 73, 96  
 perifornical region . . . . 68  
 Peter, Jörg Hermann . . . . 4, 35, 57, 58, 73, 74, 83, 96  
 Pevernagie, Dirk . . . . 3, 4, 53, 69, 84  
 phylogeny . . . . 14, 39, 66  
 Piéron, Henri . . . . 4, 23, 39, 59, 63, 64  
 Pisa Award . . . . 10  
 point mutations . . . . 43  
 Poland . . . . 110  
 Pollmächer, Thomas . . . . 3, 5, 7, 12, 13, 14, 16, 27, 31, 79, 82, 96  
 Polo, Olli . . . . 93  
 polymorphisms . . . . 37, 44  
 Pompeiano, Ottavio . . . . 75, 77  
 pontine tegmentum . . . . 65  
 ponto-geniculo-occipital . . . . 23, 66  
 Popoviciu, Liviu . . . . 9, 15, 16, 113  
 Porkka-Heiskanen, Tarja . . . . 12, 18, 21, 78, 82, 93  
 Portugal . . . . 111  
 positron emission tomography . . . . 19, 23, 41  
 posttraumatic . . . . 42  
 Pötzl, Otto . . . . 51  
 Precht, Heinz . . . . 47, 49  
 prefrontal cortex . . . . 63  
 pregnancy . . . . 22, 28, 38  
 proceedings . . . . 9, 11, 13, 58, 75, 113  
 psychiatry . . . . 7, 8, 13, 14, 31, 33, 49, 58, 61, 73, 74, 83, 90, 92, 96, 97, 98, 102, 109, 117, 120, 121  
 psychology . . . . 3, 7, 8, 9, 19, 24, 33, 38, 42, 47, 59, 63, 64, 73, 75, 86, 87, 90, 98, 102, 104  
 Purkinje . . . . 61

## R

rats . . . . 20, 21, 25, 39, 66, 68  
 RBD . . . . 27, 28, 29  
 Rechtschaffen, Allan . . . . 39  
 REM . . . . 17, 19, 20, 21, 22, 23, 24, 25, 27,  
 28, 31, 37, 39, 41, 42, 43, 48, 51, 59, 65,  
 70, 113  
 REM sleep . . . . 17, 19, 21, 22, 23, 24, 25,  
 27, 28, 31, 37, 39, 41, 42, 43, 48, 59,  
 65, 70  
 REM sleep latency . . . . 31  
 reptiles . . . . 39, 66  
 Restless Legs Syndrome (RLS) . . . . 15, 27, 28,  
 29, 50, 75, 76, 118, 122  
 reverse genetics . . . . 43  
 Riemann, Dieter . . . . 3, 7, 11, 31, 33, 41, 42,  
 73, 82, 96  
 Riha, Renata . . . . 18  
 Romania . . . . 113  
 Rotenberg, Vadim . . . . 58, 60  
 Roth, Bedřich . . . . 27, 58, 90  
 Russian Federation . . . . 114

## S

Sadeh, Avid . . . . 18, 47  
 Saletu, Bernd . . . . 83  
 Salzarulo, Piero . . . . 3, 9, 16, 33, 41, 42, 47,  
 49, 75, 77, 78, 104  
 Santamaria, Joan . . . . 3, 27, 28, 117  
 schizophrenia . . . . 38  
 school . . . . 4, 7, 17, 21, 38, 39, 50, 57, 59,  
 60, 65, 67, 71, 72, 73, 75, 88, 98, 111,  
 114  
 Schredl, Michael . . . . 3, 41, 42  
 Schulz, Hartmut . . . . 2, 3, 5, 9, 17, 19, 33,  
 73, 74, 78, 79, 80, 96  
 Schwartz, Sophie . . . . 3, 41, 42  
 scientific committee . . . . 9, 10, 13, 14, 15,  
 95, 103  
 Scollo-Lavizzari, D. . . . 9  
 Seasonal Affective Disorder . . . . 38  
 seizures . . . . 22, 28, 75  
 serotonin . . . . 22, 65  
 Shepovalnikov, Aleksandr N. . . . 60, 114,  
 115  
 Sherrington, Charles . . . . 69, 71  
 shift workers . . . . 38, 55  
 single nucleotide polymorphism . . . . 43  
 Skene, Debra J. . . . 3, 7, 12, 18, 37, 38, 81  
 sleep center . . . . 14, 62, 73, 91, 93, 103, 120,  
 121, 123  
 sleep centre . . . . 8, 53, 67, 90, 93, 123, 124  
 sleep deprivation . . . . 7, 20, 21, 28, 31, 37,  
 38, 39, 44, 58, 59, 63  
 sleep disordered breathing . . . . 28, 35, 73,  
 74, 84, 89, 113, 119  
 sleep drunkenness . . . . 27  
 sleep duration . . . . 37, 39, 49, 50, 55, 56  
 sleep EEG . . . . 20, 21, 31, 37, 39, 43, 45, 49,  
 60  
 sleep gate . . . . 20  
 sleepiness . . . . 7, 13, 19, 20, 22, 35, 55, 56,  
 58, 61, 63, 69, 73, 103, 112, 122, 124  
 sleep-like behaviour . . . . 68

sleep medicine . . . . 3, 4, 5, 7, 8, 10, 11, 12,  
 14, 18, 19, 22, 27, 33, 35, 36, 38, 39, 42,  
 49, 50, 53, 54, 55, 56, 57, 58, 60, 61, 62,  
 73, 74, 75, 83, 84, 85, 86, 87, 88, 89, 90,  
 91, 92, 93, 94, 95, 96, 97, 98, 99, 100,  
 101, 102, 103, 104, 106, 107, 108, 109,  
 110, 111, 112, 113, 114, 115, 116, 117,  
 118, 119, 120, 121, 122, 123, 124  
 Sleep Medicine Committee (SMC) . . . . 11, 53  
 Sleep Network Sessions . . . . 15  
 sleep paralysis . . . . 27  
 sleep regulation . . . . 13, 14, 20, 21, 23, 24,  
 25, 31, 37, 39, 52, 61, 67, 68, 70  
 sleepwalking . . . . 27, 29, 51  
 Slovenia . . . . 116  
 slow-wave activity . . . . 20, 24, 25, 39  
 Soldatos, Constantin R. . . . 98  
 somnologist . . . . 53, 59  
 Spain . . . . 117  
 spectral analysis . . . . 37, 39, 75  
 Spiegel, Karine . . . . 18, 94  
 Stenberg, Dag . . . . 78, 82, 93  
 Steriade, Mircea . . . . 113  
 stimulation . . . . 20, 21, 25, 51, 63, 67, 68,  
 70, 71  
 Stradling, John . . . . 17, 22, 57, 123  
 Strauch, Inge . . . . 33, 41, 68  
 stress . . . . 13, 33, 35, 42, 55, 56, 73, 94, 115  
 stroke . . . . 14, 27, 28, 36, 57, 58, 61, 68  
 substantia nigra . . . . 61, 62  
 substantia reticularis . . . . 61  
 sudden infant death syndrome . . . . 49  
 Sullivan, Colin . . . . 35  
 Sweden . . . . 119  
 Switzerland . . . . 120  
 synucleinopathies . . . . 27

## T

Tafti, Mehdi . . . . 3, 18, 27, 37, 43, 120  
 Terzano, Mario Giovanni . . . . 75, 102  
 thalamus . . . . 7, 61, 62, 67, 68, 71  
 The Netherlands . . . . 107  
 thermoregulation . . . . 20, 24  
 theta activity . . . . 19, 25, 37, 66  
 Tobler, Irene . . . . 3, 10, 12, 14, 15, 16, 17,  
 20, 21, 37, 39, 78, 80, 81, 120  
 Tononi, Giulio . . . . 10, 24, 37, 39  
 torpor . . . . 39  
 traffic accidents . . . . 35, 87  
 Travel Awards . . . . 11  
 Trenkwalder, C. . . . 28, 96  
 trophotropic . . . . 24, 67, 68  
 Turkey . . . . 121  
 twin pairs . . . . 43  
 two-process model . . . . 20, 24, 37

## V

Valatx, Jean Louis . . . . 15, 43, 94, 113  
 van den Hoofdakker, Rudi . . . . 17, 31, 79,  
 107  
 Vein, Aleksandr M. . . . 58, 60, 114  
 Visser, Piet . . . . 15, 16, 33, 107  
 VLPO . . . . 62  
 Vogel, Gerald . . . . 27, 43, 77  
 von Economo, Constantin . . . . 4, 23, 27, 29,  
 61, 62, 67, 69, 71

## W

wakefulness . . . . 9, 19, 20, 21, 23, 24, 25, 27,  
 37, 43, 51, 55, 60, 63, 67, 69, 71, 72, 77,  
 113, 115, 119  
 Westphal, C. . . . 27  
 Whitehouse, Inga . . . . 18  
 Wiechmann, Maria . . . . 12, 81, 82  
 Wiggs, Luci . . . . 18  
 Willis, T. . . . 27  
 Wirz-Justice, Anna . . . . 3, 5, 19, 20, 31, 37,  
 38, 68, 78, 79, 81, 120  
 work . . . . 4, 5, 13, 19, 21, 22, 31, 33, 35, 36,  
 37, 38, 39, 41, 42, 43, 47, 49, 53, 55, 56,  
 57, 59, 61, 63, 70, 71, 72, 74, 75, 92, 112  
 work hours . . . . 13, 55, 56  
 World Sleep Federation (WSF) . . . . 11

## Y

Young Scientist Symposium . . . . 15

## Z

zebra fish . . . . 43  
 Zeitlhofer, Josef . . . . 83  
 Zulley, Jürgen . . . . 10, 13, 33, 37, 79, 80, 81,  
 96

