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PRESIDENT'S MESSAGE

Dear SRS Members,

Thank you for the opportunity and privilege to serve this past year as President of our vibrant scientific society. As my time winds down, reflection on the year's events reveals the SRS has continued to grow (875 members) and evolve as it faces new and exciting opportunities. As our governance has expanded through new programs, initiatives, and committees, more and more members have become involved in volunteering time, ideas and energy to help SRS realize its mission to foster scientific investigation of sleep and sleep disorders; promote training and education in sleep research; and provide forums for the exchange of knowledge pertaining to sleep.

The list of initiatives accomplished this past year by our volunteer members is exciting. Some of the highlights include the following. Under the able and tireless leadership of SRS Publications Chair, Dr. Christine Acebo, and diligent service of the SRS members on the Web Services Committee, our new website was launched this past year (www.sleepresearchsociety.org). The content continues to grow and is easily updated, making the site increasingly useful to members and non-members as more material is added to it.

Through the sustained efforts of Drs. Mary Carskadon, Tom Roth, David Dinges, Patricia Prinz and Robert McCarley the first J. Christian Gillin Endowment for Junior Faculty was awarded to Washington State University this year. The award will provide \$45,000 per annum in support for up to 3 years for Dr. David Recter, a new assistant professor focusing on sleep research. The award bears the name of SRS member and Past-President, Dr. J. Christian Gillin, who together with his family launched the endowment with a generous gift. Additional private and corporate donors are being sought for future awards. The award is tangible evidence that SRS remains deeply committed to helping foster early career opportunities for sleep scientists.

This past year the SRS Board established the Education and Scientific Review Committee, chaired by Dr. Kingman Strohl, to review the growing number of applications the Society receives annually for support of workshops and special sessions for the exchange of scientific information. This Committee, together with the long-standing Training and Education Committee, ably chaired by Dr. Ron Szymusiak, serve to ensure that SRS maintains a committed focus on education and training in sleep science. The



Board also authorized formation of the Government Affairs Committee and the J. Christian Gillin Junior Faculty Development Committee. These join the other SRS committees which include the Awards Committee (chaired by Dr. Dennis McGinty), Budget Committee (chaired by Dr. Merrill Mitler), Committee on Animal Research Ethics (Chaired by Dr. Adrian Morrison), Membership Committee (chaired by Dr. Jodi Mindell), Nominating Committee (chaired by Dr. Ralph Lydic), Publications/Web Services Committee (chaired by Dr. Christine Acebo), and International Outreach Committee (chaired by Dr. Michael Vitiello). The SRS is always seeking members who wish to become involved in Society activities through participation on committees. To add your name to a list of prospective volunteers, please contact Lance Brink at the SRS National Office (507-285-4388).

The Society has also worked closely with the American Academy of Sleep Medicine this past year to ensure that the annual APSS scientific meeting and the journal SLEEP continue to reflect the very best the field of research and medicine has to offer. The Program Committee for the 2002 APSS meeting in Seattle (June 8-13), under the leadership of Dr. David White, has put together an extensive offering. In addition to SRS Trainee Day, there are 15 post-graduate courses in the pre-meeting period. From Monday,

June 10, through Thursday, June 13, the scientific offerings are extensive: 21 symposia; 181 oral presentations; 34 panel symposia; 529 poster presentations; 9 invited lectures; 9 discussion groups; and 54 Meet-the-Professor sessions. Remarkably, of 760 abstracts submitted to the 2002 APSS Program Committee, 274 (36%) of the first authors of abstracts are not members of either SRS or AASM. This is yet another sign that our field continues to grow and that we must understand what brings scientists to our meeting and determine ways to capture these submitters as members and regular contributors to sleep science.

The SRS also worked with AASM this past year on other initiatives of mutual interest. On behalf of the SRS Board of Directors, I sent a letter of support for the AASM's application to the Accreditation Council on Graduate Medical Education requesting the establishment of a Residency Review Committee to create nationally recognized 1-year fellowship training programs in sleep medicine. Through the Joint Operations Committee, the two societies supported development of a number of publications. The SRS also supported the AASM Board's decision to relocate the central office from Rochester to Chicago, in facilities convenient to O'Hare International Airport. The move will occur this summer, and it will be an opportunity for the SRS to consider expanding its administrative core to better assist the leadership in the day-to-day operation of the Society's growing number of activities. I am grateful to Mr. Jerome Barrett, AASM Executive Director, Lance Brink, Kim Van Brunt, and Roxy Haneman for their help in facilitating SRS's operations this past year.

This past year has also seen the involvement of a number of SRS members on the new NIH National Sleep Disorders Research Plan Revision Task Force. The draft plan will soon be completed and available for comments and suggestions. The previous plan, formulated in 1996 is in its terminal year and the new draft plan will be recommended to the Sleep Disorders Research Advisory Board of the National Center for Sleep Disorders Research. The final strategic research plan represents an important opportunity for SRS to help focus an agenda for NIH support for scientific research on sleep. The plan will provide a critical roadmap for NIH-initiated sleep research efforts over the next 5 years. It is of great importance to all sleep researchers.

As the year roles over at the APSS meeting, please join me in congratulating Dr. Emmanuel Mignot (incoming President-Elect), Dr. Mark Opp (incoming Secretary Treasurer), Dr. Barbara Jones (incoming Basic Sleep Section Head) Dr. Roseanne Armitage (incoming Sleep and Behavior Section Head) and Jennifer Martin (incoming Trainee Representative). I want to express my own personal gratitude to Dr. Ralph Lydic (outgoing Past President),

Dr. Merrill Mitler (outgoing Secretary Treasurer), Dr. Chiara Cirelli (outgoing Basic Sleep Section Head), Dr. Richard Bootzin (outgoing Sleep and Behavior Section Head), and Dr. Scott Doran (Trainee Representative) who helped make this past year a successful one for me personally and for SRS. Also, please join me in giving your support and best wishes to Dr. Ruth Benca, who will assume the Presidency of SRS at APSS.

I leave you with this final thought. As we grow with and continue to adjust to the growth of the sleep field, we must also continue to entertain new ideas, and experiment with new initiatives. The Sleep Research Society has a rich diversity of academic disciplines represented among its membership, and a growing number of research opportunities. We must strive to increase the number of younger scientists in our field and create the career paths that will permit them to make scientific contributions for years to come.

My thanks to all of you for your support this past year. I look forward to seeing you in Seattle.

David F. Dinges, Ph.D.

Editor's Comments

by Larry D. Sanford, Ph.D.

With this issue, the Bulletin will begin to be distributed electronically via email. Current and archival issues will be available on the SRS website (<http://www.sleepresearchsociety.org/resources/publications>). This method has advantages in reduced costs and ease of distribution. Back issues will also be readily accessible. The downside, of course, is that hard copies will only be available by printing the PDF, and we would welcome comments regarding this mode of distribution.

The American Physiology Society, under the auspices of its Latin American Initiative, funded a symposium entitled "Stressor-induced alterations in sleep". This symposium was held in October 18-19, 2001, in Sao Paulo, Brazil. In the last issue of the SRS Bulletin we featured three of the invited lectures. In this issue, we present two more of the invited lectures given at the symposium.

This issue carries the announcement of the creation of a new journal, *Hypnos*, sponsored by the Latin American Sleep Research Society. We wish them well in this exciting endeavor.

As always, your comments and suggestions are welcome.

Correction: The footnotes on pages 69-71 of Volume 7, No 3, Winter 2001 were incorrectly identified as Volume 7, No 2, Summer 2001.

Limbic Function and Emotional Stress: Implications for Sleep

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1. Introduction

Studies of sleep control have concentrated on three basic regulatory processes. Homeostatic processes are responsible for the increase in “sleep pressure” during wakefulness and its subsequent dissipation during sleep (reviewed in Borbély, 1994). Circadian processes regulate “sleep propensity” in a clock-like fashion within the 24 hour day (reviewed in Borbély, 1994) and ultradian processes are reflected in alternating periods of NREM and REM within sleep (McCarley & Hobson, 1975). These processes can account for the internal “drive” for sleep and for the influence of periodic geophysical zeitgebers such as light on the normal distribution of sleep and wakefulness throughout the day. However, the determination of when and for how long sleep occurs is also influenced by the myriad stimuli and events an organism experiences. While this influence may be obvious, especially for situations that produce discomfort and real or potential danger, sleep may also be disrupted without an easily identifiable, observable cause. Such instances may involve emotion, drive and need states, learning history and memory, and interactions between the physical environment and physiology. The ways in which such factors affect the relative occurrence of sleep and wakefulness are poorly understood and the topic has received little attention by researchers studying the neurophysiology of sleep, possibly because a potential neural substrate had not been identified.

Recent work has directly implicated the amygdala in the regulation of arousal state (Calvo et al., 1996; Sanford et al., 1995; 1998; Silvestri et al., 1998). This research, coupled with its more widely recognized functional roles, produces a reasonable case that the amygdala could be a central mediator for the influence of emotion and external events on sleep-wake regulation. The amygdala has generally become regarded as the center of emotion in the limbic system (LeDoux, 1992) and it plays a critical role in conditioned fear, and probably anxiety (Davis, 1990; Davis, 1992). The amygdala also appears to have a pivotal role in the influence emotion has on memory formation (Gallagher & Holland, 1994). It is important in forebrain regulation of behavioral, physiological and neuroendocrine responses to stress (Bohus et al., 1996). The amygdala, particularly the central nucleus (CNA), is implicated in the modulation of autonomic phenomena including heart rate, blood pressure and respiratory activity patterning (Roozendaal et al., 1991a; Roozendaal et al., 1991b; Frysinger et al., 1988; Frysinger et al., 1989), especially as related to stress (Roozendaal

et al., 1991b). Further, the amygdala is the recipient of sensory information of all modalities from cortical and subcortical structures; and, in turn, the amygdala projects to diverse neural structures including thalamic, hypothalamic and brainstem target regions (Amaral et al., 1992) that have been implicated in sleep-wake regulation.

2. Anatomical Substrate for Amygdalar Modulation of Arousal State

The evidence thus far most strongly implicates CNA in the regulation of behavioral state. Other regions of the amygdala appear less directly involved (Calvo et al., 1996; Sanford et al., 1995; Sanford et al., 1998), though they may play a role in modulating CNA. CNA is the origin of the major descending output of the amygdala to brainstem regions considered central to the control of REM and its related phenomena. Efferents from CNA are split between two major amygdaloid output tracts, the stria terminalis and the ventral amygdalofugal pathway, the caudal part of which enters the brainstem (Price et al., 1987). There is a major amygdaloid-peribrachial pathway originating exclusively in CNA and projecting to the peribrachial region of the pontomesencephalic tegmentum (Krettek & Price, 1978; Moga & Gray, 1985; Moga & Gray, 1995; Price et al. 1987; Takeuchi et al. 1982). Projections from CNA also go to the pedunclepontine and laterodorsal tegmentum (PPT and LDT), locus coeruleus (LC), LCa, and subcoeruleus, and to the dorsal raphe nucleus (DRN). Projections to LC apparently go to the rostral pole and to the dendritic fields, not the main body of the nucleus (Lechner & Valentino, 1999; Van Bockstaele, 1998). All of these regions are implicated in REM generation (Steriade & McCarley, 1990), and there are reciprocal projections from many of these regions back to CNA (Bernard et al., 1993; Krettek & Price, 1978; Moga & Gray, 1985; Moga & Gray, 1995; Petrov et al., 1993; Peyron et al., 1998; Price et al., 1987; Saper & Loewy, 1980; Semba & Fibiger, 1992; Takeuchi et al., 1982). In addition, a major pathway originating in CNA and projecting to the lateral parabrachial region of the pontomesencephalic tegmentum has been demonstrated in several species including rats (Bernard et al., 1993; Krettek & Price, 1978; Moga & Gray, 1985; Moga & Gray, 1995;) and cats (Krettek & Price, 1978). This region also has been demonstrated to have an important role in the generation of REM and PGO waves (Datta et al., 1992a; Datta et al., 1992b).

Connections between the amygdala and other forebrain regions may also be important in its influence on sleep-wake states. The amygdala has reciprocal connections with both the thalamus and hypothalamus (Amaral et al., 1992), which have demonstrated roles in the regulation of sleep. The amygdala receives dense cholinergic innervation, mainly from the nucleus basalis – substantia innominata complex, cholinergic cell group (Ch4) neurons (Woolf & Butcher, 1982). In rats, dense innervation by ChAT-positive fibers is found in the basolateral amygdala (BLA), medium density in the lateral amygdala (LA), cortical, accessory basal nucleus, the periamygdaloid cortex and the anterior amygdaloid area and low density in medial and CNA (Heckers & Mesulam, 1994). Cholinergic input reaches the amygdala from Ch4 via relatively short fibers in the ventral amygdalofugal pathway and by a bundle of longer fibers which traverse the stria terminalis, curve caudally, and descend posterior to the internal capsule to reach the

caudal pole of the amygdala" (Heckers & Mesulam, 1994). A modest cholinergic input from the LDT/PPT (Ch5 and Ch6) in the upper brainstem has also been reported (Woolf & Butcher, 1982). Interestingly, the basal forebrain in rats has reciprocal connections with the brainstem reticular formation including PPT/LDT (Jones & Beaudet, 1987; Losier & Semba, 1993; Satoh & Fibiger, 1986). In cats, neurons in the basal forebrain have been reported with increased firing in REM and alert wakefulness, as well as a group of neurons that increase firing at sleep onset and during NREM (Szymusiak & McGinty, 1986; Szymusiak & McGinty, 1989). Cells with similar state-related firing patterns have also been found in the anterior hypothalamic and medial preoptic areas in rats (Koyama & Hayaishi, 1994). The existence of these cells suggests that the basal forebrain contains neurons that may promote sleep as well as neurons that are involved in cortical activation (Szymusiak, 1995; Szymusiak & McGinty, 1989). Given the demonstrated role the basal forebrain plays in arousal, the reciprocal connections with the amygdala suggest another possible pathway by which the amygdala can influence, and be influenced by arousal state.

The bed nucleus of the stria terminalis (BNST), considered to be extended amygdala, may also be involved. BNST has recently been suggested to be a neural substrate for anxiety (Lee & Davis, 1997; Davis & Whalen, 2001), has reciprocal connections to the amygdala, and via the lateral BNST (Davis & Whalen, 2001), has similar descending projections to those of CNA (reviewed in Amaral et al., 1992). Lee & Davis (1997) have linked CNA to conditioned fear and BNST to unconditioned fear and anxiety. BNST is not necessary for fear conditioning to a specific explicit cue, but lesions of BNST do block the gradual elevation in baseline startle that accompanies repeated shock (Gewirtz et al., 1998). To date, there have been no studies examining the role of BNST in behavioral state regulation. However, given its suggested role in anxiety and similar efferent projections, BNST and CNA could have complementary roles in regulating the influence of anxiety, fear and stress on behavioral state control.

3. Amygdalar Modulation of Arousal

The first suggestion that the amygdala might be involved in the actual regulation of sleep occurred in the early sixties (Adey et al., 1963). Throughout the years since, studies by sleep researchers have reported on the effects of electrically stimulating the amygdala on EEG (Kreindler & Steriade, 1964), PGO waves (Calvo et al., 1987), REM (Smith & Miskiman, 1975; Smith & Young, 1975) and several studies have examined the influence of the amygdala on autonomic variables during wakefulness and sleep (Frysinger et al., 1988; Frysinger et al., 1989; Harper et al., 1984; Schulz et al., 1996; Zhang et al., 1986). Studies in narcoleptic dogs have also implicated the amygdala in cataplexy (Mignot et al., 1988a; Mignot et al., 1988b; Gulyani et al., 1998). In addition, a finding of increased cerebral blood flow in the amygdala during REM in humans (Maquet et al., 1996) was interpreted as a possible link between emotionality controlled by the limbic system and dream content. REM has been the general focus of studies involving the amygdala and sleep; however, recent studies examining the role of the amygdala in regulating arousal states indicate that the amygdala may influence all sleep-wake states (Sanford et al., 1995; Sanford et al., 1998; Silvestri et al., 1998).

There is a growing body of evidence, mainly from microinjection studies, that the amygdala modulates arousal state through the descending pathways originating in CNA. Serotonin (5-HT) infused into the amygdala during REM induces a state change, whereas antagonizing 5-HT increases total sleep and releases PGO waves in NREM (Sanford et al., 1995). Carbachol microinfused into CNA increases wakefulness and reduces REM in rats (Silvestri et al., 1998), and has been reported to increase REM and PGO waves in cats (Calvo et al., 1996). Most recently, we have found that inactivating CNA with nanomolar concentrations of the GABA_A agonist, muscimol, selectively suppresses REM for up to 6 hours (Sanford & Tang, 2001). The amygdala may also influence NREM. Microinjections of prolactin into CNA suppress NREM with minimal effects on REM or transitional sleep (Sanford et al., 1998). Collectively, these findings and the anatomical evidence indicating reciprocal connections between the amygdala and DRN and LC (Fallon & Ciofi, 1992) suggest a synergy between the brainstem and the amygdala in controlling arousal. Cholinergic input from either the basal forebrain, and or LDT/PPT may also be involved. These connections also suggest functional and neural substrates by which emotion could affect arousal, and, in turn, possible pathways by which variations in arousal could influence emotional responding.

4. Conditioned fear and sleep

The conditioned fear paradigm is a powerful classical conditioning procedure in which an association is formed between a neutral cue, usually tone or light, or context and an aversive stimulus, usually footshock. After sufficient pairings to shock, the cue and context begin to elicit responses very similar to those previously elicited by the footshock. The physiological outcomes of fear conditioning closely mimic those seen in human anxiety disorders (Davis, 1992). Indeed, the concepts of anxiety and fear are closely related although fear is considered to be stimulus specific whereas anxiety is more generalized (Davis, 1992).

We are beginning to examine the efficacy of fear conditioning as a possible model for investigating the influence of emotionally significant stimuli and events on sleep. Sleep after the shock training portion (shock given) of the paradigm is typically characterized by relatively specific decreases in REM in both rats (Sanford et al., 2001a) and mice (Sanford et al., 2001b). Decreases in REM have been observed as long as 5 hours after shock training was terminated in BALB/cJ mice. These mice exhibit relatively greater reactivity on behavioral tests of anxiety. In Sprague-Dawley rats and in less reactive C57BL/6J mice, reductions in REM have been observed for up to two hours after experiencing shock training. Post-training NREM was minimally affected or actually increased in rats and C57BL/6J mice (Sanford et al., 2001a; Sanford et al., 2001b), though this may vary with strain. The critical finding is the impact of fear-conditioned reminders or cues on sleep. Fearful cues produced alterations in sleep that were similar to those observed after shock, and these alterations varied amongst strains, with strains that showed greater "anxiousness" on behavioral tests of anxiety showing the greatest alterations in sleep. REM was the sleep state most affected in all strains, though NREM and total sleep were also altered in the "anxious" mice. These effects, depending on strain, last for an extended period after shock training and/or presentation of the cue. Surprisingly,

longer-term, delayed reductions in REM and NREM also were observed several hours after shock training or cue presentation. Thus, fear conditioning may provide a way to experimentally investigate the processes and neural mechanisms by which emotionally charged stimuli affect sleep.

The amygdala is critical for both explicit, cue-specific fear conditioning and contextual fear conditioning, which does not depend on the presentation of temporally associated cues (Muller et al., 1997; Phillips & LeDoux, 1992). Fear-conditioned cue (e.g., light, tone, touch) information activates CNA which then would activate hypothalamic and brainstem regions responsible for producing indicators of fear (Davis, 1998; Rosen & Schulkin, 1998). Information regarding situations associated with aversive events activates BNST, which also on hypothalamic and brainstem areas involved in fear or anxiety (Davis, 1998). Because the information associated with this latter experience may be relatively nonspecific and longer lasting compared to that produced by an explicit fear-conditioned cue, BNST could be more involved in anxiety than in fear (Lee & Davis, 1997). Thus, CNA and BNST may have complementary roles in controlling brainstem mediated responses to fear and anxiety provoking situations, with CNA involved in immediate responses to explicit cues and stimuli, and with BNST involved in longer-term, less specific reactions. If true, BNST may have a role in the effects of fear conditioning on REM, which can be suppressed for an extended period after exposure to the cue or context.

5. Conclusion

Sleep-wake states are influenced by an organism's internal emotional and drive status, its environment and the interaction between the environment and physiology. The impact of these factors is clearly recognized in many sleep disorders, and disorders in which sleep is affected. Emotion, stress and environmental factors particularly have been associated with transient and short-term insomnia (reviewed in Roehrs et al., 1994) and some theories of primary insomnia (reviewed in Stepanski, 1994). Posttraumatic Stress disorder (PTSD) is classified as an anxiety disorder and is characterized by hypervigilance to unfamiliar stimuli and stereotypical anxiety dreams (Ross et al., 1994a; Ross et al., 1994b). The amygdala is a structure likely to mediate the characteristic traits of this disorder (Charney & Deutch, 1996).

The amygdala may be a key region for regulating the influence of emotion and the environment on sleep and wakefulness. This suggestion stems from the facts that the amygdala receives sensory input from all modalities, is central to the role emotion plays in the integration of physiology and behavior and appears to have a direct modulatory influence on sleep-wake regulation. Thus, the role of the amygdala plays in evaluating and storing the emotional significance of events may be an essential component of its role in sleep-wake regulation.

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Paradoxical Sleep Deprivation and the Hypothalamic-Pituitary-Adrenal Axis

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1. INTRODUCTION

The discovery of a sleep state in which humans exhibit rapid eye movements (REM), brain electrical activity similar to waking and stage 1, and muscle atonia was a hallmark in the field of sleep studies. This sleep phase, known as REM sleep or paradoxical sleep (PS)², together with the function of sleep, has represented the most complex and intricate issue in sleep research. Because of its unique characteristics and its association with dreaming, many groups sought to understand the function(s) of paradoxical sleep. One of the most used approaches to study PS function(s) is to deprive humans or animals of this sleep phase.

PS deprivation studies in animals were made possible by the invention of a technique by Jouvet and co-workers (1964). This paradigm, first used in cats, consists of placing an animal on top of an inverted flower pot. With the onset of PS, and consequently, of muscle atonia, the animal falls in the water and is awakened. This method was later adapted for use in rats (Cohen & Dement, 1965) and has since been used in numerous studies.

1.1. Functions of paradoxical sleep

Paradoxical sleep has been associated with maturation of the central nervous system (CNS), since time spent in this sleep stage is far higher in babies and children than in any other age (Curzi-Dascalova & Callamel, 2000).

PS has also been implicated in memory processes, since task acquisition is impaired if an animal is prevented from sleeping after training (Dujardin et al., 1990; Hennevin & Leconte, 1977; Pearlman, 1979; Smith, 1985; Smith & Wong, 1991). This hypothesis, however, is not universal, insofar as many studies show that PS deprivation-induced memory impairment depends on the method of PS deprivation, rat strain and nature of the task to be learned (Bueno et al., 1994; Dametto et al., 2002).

Another line of research has attributed to PS a role in energy conservation. This idea is derived from findings showing that, regardless of the method used, PS deprivation induced hyperphagia concomitant to weight loss (Brock et al., 1994; Elomaa, 1985; Kushida et al., 1989; Suchecki & Tufik, 2000), reflecting increased metabolic rate and energy expenditure. This increased energy demand may be caused by excessive loss of body temperature that occurs with very long periods of PS deprivation (Landis et al., 1992).

Finally, several sleep researchers have explored the possible role of paradoxical sleep on neurotransmitter function. Their hypotheses are based on the fact that PS deprivation alters receptor binding density of several neurotransmitters, including noradrenergic (Siegel & Rogawski, 1988; Hipólido et al., 1998), cholinergic (Nunes Jr. et al., 1994b) and dopaminergic receptors (Brock et al., 1995; Nunes Jr. et al., 1994a) in addition to neurotransmitter-mediated behaviors (Neumann et al., 1990; Tufik, 1981; Tufik et al., 1978; Tufik et al., 1987).

Because all instrumental methods utilized to induce sleep deprivation alter stress indexes and almost, if not all, of the above-mentioned studies have employed instrumental methods to induce PS deprivation, there has always been the question of whether PS deprivation-induced alterations result from the stress resulting from the method or from the suppression of this sleep phase. In any case, I do not believe that preventing an animal or a human from sleeping

is not stressful. Thus, in my opinion, PS deprivation could be considered a stressor itself. However, as I shall show later, it appears as though the way the animal is PS-deprived may differentially affect the stress response to a further stressor.

In the last years, the effects of sleep deprivation or any kind of sleep disruption (fragmentation, curtailment) on the hypothalamic-pituitary-adrenal (HPA) axis has received attention as more than just being considered a byproduct of a stressful procedure. Thus, several groups are specifically interested in the effects of sleep deprivation and its varieties on the physiology of a hormone axis that may influence the whole body's function.

2. PHYSIOLOGY OF THE HPA AXIS

Release of glucocorticoids (GCs) from the adrenal cortex and catecholamines from the adrenal medulla serves the main purpose of elevating blood glucose levels during stress, by mobilizing and distributing energy substrates. This is accomplished in several ways by glycogenolysis and lipolysis in an earlier phase and gluconeogenesis and muscle proteolysis in a later stage (Sapolsky et al., 2000). GCs (cortisol in humans and primates and corticosterone in rats) are the end product of the HPA axis, which is activated by stress in a cascade-like manner.

The cascade is initiated with the secretion of corticotropin-releasing hormone (CRH) and arginine vasopressin (AVP) and oxytocin from the paraventricular nucleus of the hypothalamus (PVN). Increased levels of these secretagogues leads to the cleavage pro-

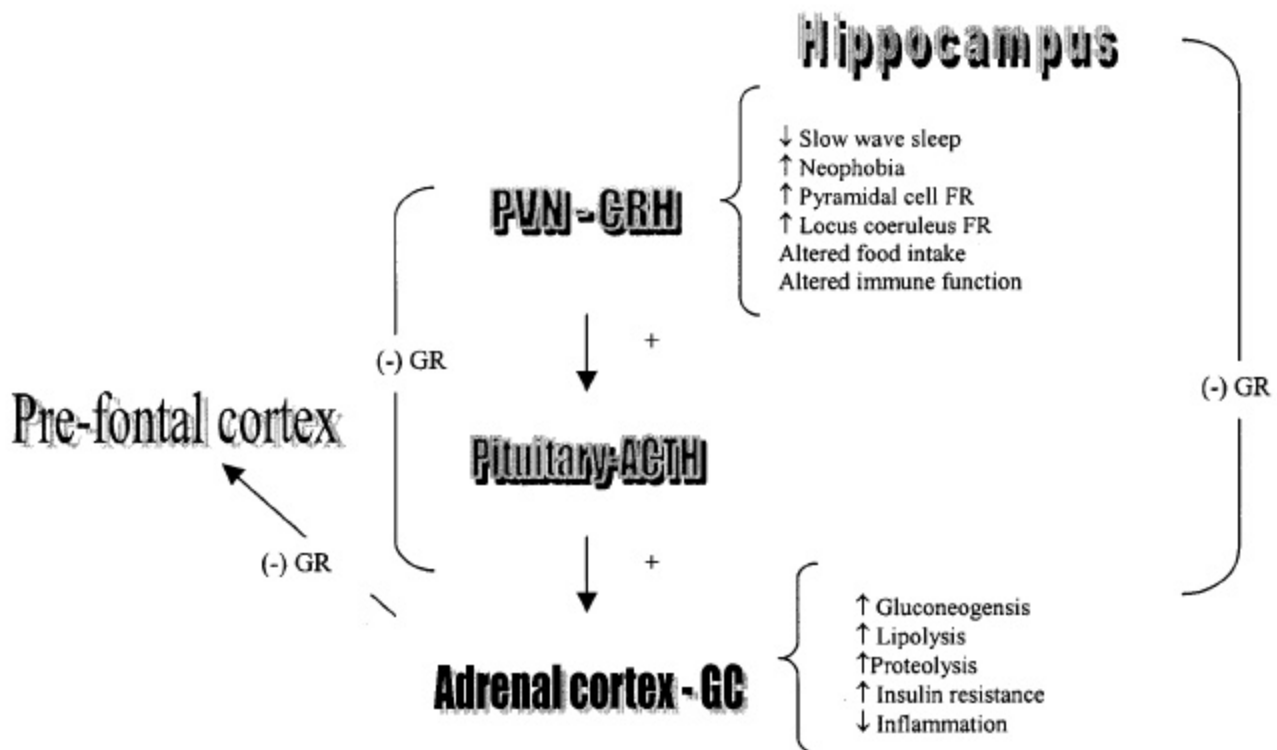


Figure 1 - Schematic representation of the activation (+) and inactivation (-) of the HPA axis. Inactivation or GC (glucocorticoid) negative feedback is accomplished, mainly, by glucocorticoid receptors (GR) at pituitary, hypothalamus, pre-frontal cortex and hippocampus (adapted from Arborelius et al., 1999).

cessing of the proopiomelanocortin molecule, resulting in the synthesis of adrenocorticotrophic hormone (ACTH) and β -endorphin (Rivier & Plotsky, 1986; Whitnall, 1993). Once released, ACTH acts on specific membrane receptors in the adrenal cortex and stimulates synthesis and release of GCs (Rachamandran et al., 1977). These steroids are highly catabolic and excessive and prolonged exposure of the organism to GCs leads to suppression of anabolic processes, muscle atrophy, decreased sensitivity to insulin, hypertension, impairment of growth and tissue repair and immune suppression, among other metabolically costly processes (Caldji et al., 2001). Therefore, it is highly adaptive for the organism to exhibit a fast onset of the HPA axis response, but especially to shut it down as quickly as possible. The ability of GCs to regulate CRH and ACTH release by a negative feedback loop determines the activity of the axis. GC negative feedback occurs in several brain areas, including the hippocampus and the PVN, and in the pituitary, by means of specific GC receptors, mineralocorticoid and glucocorticoid receptors - MR and GR, respectively (De Kloet, 1991). Therefore, in control rats, the usual ACTH peak is seen 5-15 min and that of corticosterone (CORT), 20-30 min after an acute stress. By 60 min after the stressor both hormones are expected to be back to basal levels. A schematic representation of the regulation of the HPA axis is presented in Figure 1.

2.1. Activity of the HPA axis during sleep

The activity of the HPA axis, the major neuroendocrine transducer of the stress response, is mainly driven by circadian rhythmicity. Increased activity of the axis is observed immediately before the onset of the active period (dark period in rodents and light period in humans and primates), whereas HPA axis quiescence occurs during the rest period.

In humans, the profile of hormone secretion during sleep consists of a peak of growth hormone in the first part of the night, concomitant to the lowest levels of CRH, ACTH and cortisol. During this period, slow wave sleep (SWS) predominates. In the second half of the night there is a predominance of REM sleep and a discrete rise in ACTH and cortisol levels (Friess et al., 1995).

This quiescence in HPA axis activity during the first hours of the night has been attributed to the predominance of SWS during this period. However, subjects sleeping during the day show the same percentage of SWS than subjects who sleep at night, but no suppression of cortisol release (Weibel et al., 1995). Furthermore, SWS occurs during reduction of cortisol release on night- or daytime sleep (Follenius et al., 1992). A more detailed study involving spectral analysis shows that, when present at the same time, delta waves and cortisol secretion are negatively correlated. Cortisol changes precede variations in delta wave activity by approximately 10 min, whereas increases in delta wave activity occur in the absence of cortisol pulses. In this study no concomitant increase in delta wave activity and cortisol secretion was observed (Gonfrier et al., 1998). Similar results were reported for the relationship between delta wave activity and autonomic activity (Gronfier et al., 1999). These results suggest that reduced HPA axis activity allows SWS to occur, rather than that SWS induces inhibition of HPA axis activity (Follenius et al., 1992; Weibel et al., 1995). In addition, REM sleep that predominates in the second part of the night is also associated with reduced cortisol secretion (Follenius et al., 1992), confirming previous data that augmented

cortisol secretion is linked to light sleep and awakening (Born et al., 1986; Gronfier & Brandenberger, 1998; Luboshitzky, 2000). Not only are cortisol secretory pulses related to sleep phases, but the sensitivity of the pituitary-adrenocortical axis responds to exogenously administered human CRH (hCRH). During a night of sleep, ACTH and cortisol responses to an i.v. injection of hCRH are reduced in the first, but not in the second half of the night. Moreover, in subjects kept awake throughout the night, the pituitary-adrenocortical response is elevated both in the first and second part of the night (Späth-Schwalbe et al., 1993). The sensitivity of GC negative feedback also appears to be modulated by sleep, insofar as inhibition of the HPA axis is attenuated during sleep and once the subject is awakened, the axis becomes very sensitive to the negative feedback action of cortisol (Späth-Schwalbe et al., 1991).

3. EFFECTS OF SLEEP DEPRIVATION ON THE HPA AXIS

3.1. Human studies

Several studies have evaluated the HPA axis secretory output during sleep deprivation, with the main purpose to determine whether or not the activity of the axis is exclusively driven by the circadian rhythm (Born et al., 1988; Späth-Schwalbe et al., 1993; Weitzman et al., 1983). Some studies, in addition, sought to examine the effects of sleep deprivation or restriction on the activation of the HPA axis.

Studies on the effects of sleep deprivation on the activity of the HPA axis in humans have proven controversial. Some studies failed to show any alteration immediately after a night of total sleep deprivation. Others, however, show increased cortisol levels during the axis' quiescent period, suggesting that sleep deprivation is likely to produce an impairment of the GC negative feedback system (Leproult et al., 1997; Spiegel et al., 1999). A comparison between the activity of the HPA and GH axes show that, during the recovery night following sleep deprivation, healthy young volunteers show increased amounts of SWS along with increases in GH secretion, and decreases in cortisol release, reinforcing the negative relationship between SWS and cortisol levels (Vgontzas et al., 1999).

In modern society, voluntary sleep curtailment, rather than prolonged PS deprivation, is a frequent condition. Reduction of the sleep period to four hours (3:00 - 7:00 a.m.) results in impairment of glucose tolerance, with approximately a 40% slower clearance rate during the sleep recovery period. Moreover, insulin response to a glucose load is 30% smaller in the curtailment than in the extension (9:00 p.m. to 9:00 a.m.) period. In addition, healthy volunteers also present increased autonomic activity with elevated heart rate and blood pressure (Spiegel et al., 1999). These data, therefore, indicate that prolonged sleep curtailment is detrimental to the organism, but that the effects could be reversible by an extension of the sleep period. It would be interesting to know how long an extension of sleep would be necessary to reverse the effects of curtailment.

3.2. Animal studies

Evidence demonstrates that the flower pot (or single platform) method is stressful insofar as several peripheral and central indices of stress are altered. Increased binding of CRH receptors in several brain areas, and reduced hypothalamic CRH content is

observed in rats, suggesting increased neuropeptide release (Fradda & Fratta, 1997). Body weight loss, reduced thymus weight and increased adrenal weight (Coenen & Van Luijtelaa, 1985) as well as augmented basal and ACTH-stimulated corticosterone (CORT) levels are also observed (Patchev, 1991). These effects are most likely the consequence of constantly exposing the animal to single housing and immobilization, in addition to frequent awakenings.

In order to attenuate the effects of these intervening variables, the multiple platform method was developed. In this paradigm one rat is placed inside a large water tank containing 7 platforms, which thus allows the animal to ambulate (Van Hulzen & Coenen, 1981), but still stress indices are altered, including increased adrenal and reduced thymus weights (Coenen & Van Luijtelaa, 1985). This method was further modified in an attempt to eliminate the social isolation experienced by the animal in both the single- and the multiple platform techniques. The paradigm consists of placing 10 animals onto 14-15 narrow platforms or onto a grid (as a control for the deprivation environment). The animals must be deprived as a socially-stable groups (animals are raised together from weaning on), otherwise a new variable is introduced, which exacerbates the stress response, i.e., social instability (Suchecki et al., 1998; Suchecki & Tufik, 2000). Before PS deprivation commences, animals are adapted to the modified multiple platform method (MMPM), for one hour on two consecutive days, a period that is sufficient for the animals to learn to balance on top of the narrow platforms, so that they are prevented from unnecessary falls in the water. At the end of a period of 4 days of PS deprivation, we observed increased CORT plasma levels, relative adrenal weight and body weight loss, despite augmented food intake (Suchecki & Tufik, 2000). The MMPM is an efficient method of PS deprivation (Suchecki et al., 2000), and both the classical platform and the modified multiple platform methods suppress PS at a similar level (Machado, 2001). Socially-stable groups placed onto the grid appear to be a suitable control insofar as animals are placed in a novel environment, but neither show as an intense HPA axis activation as PS-deprived animals nor sleep rebound during a recovery period following 90 h of manipulation (Suchecki et al., 2000).

The HPA axis is sensitive to the negative feedback action of CORT. Thus, previously elevated levels of the steroid may inhibit further responses to stress. However, in chronic stress conditions, the HPA axis exhibits a facilitatory response to subsequent stressors. Therefore, "basal" CORT levels in chronically stressed animals are elevated from 5 mg/dl to 8mg/dl, but ACTH "basal" levels are generally unaltered (Dallman et al., 1991), which are basically the results we reported previously (Suchecki and Tufik, 2000). Since the properties of the HPA axis, such as activation and feedback inhibition, show adaptation to chronic stress, we sought to determine whether prolonged PS deprivation in the presence of conspecifics or not could influence the hormonal responses to a mild stressor. Thus, animals previously submitted to 96 h of PS deprivation, by the single platform method (SPM- individual deprivation) or by the MMPM (group deprivation), were challenged with a mild stressor (saline + novelty). All groups showed peak CORT levels 5 min after the stress, with PS-deprived animals showing higher peak levels than control rats. Twenty min after the stress, however, these levels remained elevated in control groups,

but returned to basal in PS-deprived animals. The fact that sleep-deprived animals showed such a fast return to basal levels could be explained by the influence of sleep on the activity of the HPA axis (Suchecki et al., 2002). In fact most of the animals were already sleeping when sampling took place, and according to our previous work, animals can initiate sleep as fast as 16.5 min after PS deprivation (Suchecki et al., 2000).

Since social support and housing conditions have been associated with the ability of animals to cope with adverse situations (Levine & Ursin, 1991; Plaut & Friedman, 1982), a study was conducted to assess anxiety-like behavior and the ACTH and corticosterone responses to the elevated plus maze of animals submitted to PS deprivation, either individually or as a group. Animals PS-deprived by the MMPM entered and spent more time in open arms than any other group. Although motor activity was enhanced in both sleep-deprived groups compared to their control counterparts, MMPM rats ambulated more in the open arms, whereas SPM rats did so in the closed arms. The hormone levels showed that PS deprivation is stressful, because both methods induced augmented basal levels of ACTH and CORT. The hormone response to the elevated plus maze was negatively related with anxious-like behavior exhibited by the animals. Thus, group deprived animals showed the fastest return of ACTH and CORT secretion to basal levels. From these data, we can conclude that the presence of conspecifics during the deprivation period profoundly influences the rat's behavior, which in turn influences the regulation of the HPA axis after exposure to the elevated plus maze (Suchecki et al., in press).

4. CONCLUSION

Data about the effects of one night of sleep deprivation on humans does not provide evidence for a major impact on the HPA axis. Prolonged sleep curtailment, on the contrary, appears to produce impairment of the GC negative feedback system and metabolic alterations that resemble the physiology of elderly (Leproult et al., 1997).

Our animal data indicate that PS deprivation, despite representing an adverse stimulus, does not impair regulation of the HPA axis. Since activation of this system is involved in metabolic function and in the activity of autonomic and central nervous system, unchecked and dysregulated stimulation of the axis may lead to numerous pathologies (Arborelius et al., 1999).

For many years, PS deprivation has been used to evaluate the possible functional significance of this sleep phase. However, the techniques developed to produce PS deprivation have been claimed to be stressful and the net result of this manipulation can not be indisputably attributed to suppression of this phase. Collectively, our results show that both methods of PS deprivation induce increased "basal" ACTH and CORT levels, indicating that suppression of paradoxical sleep is stressful regardless of the method employed. However, the manner in which animals respond to a subsequent stressor depends on the type of technique used. Thus, facilitation of the CORT response to stress, but no impairment of regulation (activation and/or termination) of the stress response to either mild or moderate stress is observed. On the one hand, fast return to basal unstressed levels is indistinguishable between PS-deprived groups in response to a mild

stress and appears to result from a faster initiation of sleep. On the other hand, animals PS-deprived as a group show less anxiety-like behavior in and smaller ACTH and CORT responses to the elevated plus maze, suggesting a differential effect of group housing on PS deprivation effects.

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2 Paradoxical sleep (PS) will be used for both humans and rats, whereas REM sleep will be used exclusively for humans.



Adrian Morrison, D.V.M., Ph.D., University of Pennsylvania, and Chair of the SRS Committee on Animal Research Ethics, presented at the Fourth Annual Walter C. Randall Lecture in Biomedical Ethics at the Experimental Biology 2002 meeting (April 20–24, 2002, New Orleans). Dr. Morrison's lecture, was entitled "Developing an Ethical Position on the Use of Animals in Biomedical Research", and presented on Tuesday, April 23, at 2:00 PM. We congratulate Dr. Morrison for this honor and recognition of his many contributions to biomedical ethics.

HYPNOS JOURNAL OF CLINICAL & EXPERIMENTAL SLEEP RESEARCH

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Scope

Hypnos is an international journal sponsored by the Latin American Sleep Research Society. The journal is committed to

publish relevant clinical and experimental research findings on sleep and wakefulness, sleep-related biological rhythms and dreaming which may help to understand the mechanisms and regulation of sleep, the consequences of its loss, its disorders and treatments.

Regularity of the journal is 3 issues per year.

Types of papers

Submission of reviews, regular research papers, short communications and case reports is welcome.

- Review papers: Should contain a deep and critical review of the proposed issue.
- Regular research papers: These are intended to disseminate original basic and clinical studies. There is no length limitation and splitting of results into smaller papers is highly discouraged.
- Short communications: These are intended to publish basic research papers of no more than 2500 words, 1 figure or table and no more than 20 references.
- Case reports: These should be no more than 1500 words (no abstract required), 1 figure or 1 table and no more than 10 references, describing important clinical issues, etiology and pathogenesis of a disease. Reports on a new or uncommon disease are welcome; they should address relevant aspects of sleep medicine.

Submission

Manuscripts should be submitted by e-mail to the Editor, with a cover letter stating that the findings are original and are not being submitted anywhere else. The authors should suggest three possible reviewers for the manuscript (including, but not obligatory, one name from the editorial board). Manuscripts should be typed in good quality paper, doubled space with margins of 2.5 cm, containing:

- Title page: Should contain the article's title which should be as concise as possible without abbreviations, complete names of the authors and their affiliations, complete postal address, telephone and fax numbers and e-mail address of the corresponding author.
- Abstract: Should be typed on a separate page, with a maximum of 250 words, followed by four to six key words.
- Main text: Should include the subheadings Introduction, Methods, Results, References, Acknowledgements, Figure legends and Tables. Possible insertion of figures and tables should be indicated in the text. When first mentioned, abbreviations should always be preceded by their full spelling, except for those well known such as ACTH, AIDS, GABA, etc.
- References: Should be cited in the text in brackets using the name of the authors, followed by year of publication. Two authors should be cited as such: Pereira & Oliveira, 1999,

(CONTINUED ON PAGE 18)

Seattle 2002

 The Associated Professional Sleep Societies' (APSS) 16th Annual Meeting will be held June 8-13, 2002 at the Washington State Convention & Trade Center (WSCTC) in Seattle, Washington.

Important Date:

May 28 - Pre-registration Deadline



Washington State
Convention &
Trade Center




Sheraton Seattle

HOTEL & TOWERS



THE WESTIN
SEATTLE

 Two co-headquarter hotels will host the 2002 Annual Meeting.

IMPORTANT LOCATION INFORMATION

Postgraduate courses will take place on Saturday, June 8 and Sunday, June 9 at the Sheraton Seattle Hotel & Towers. The scientific program is scheduled Monday, June 10 through Thursday, June 13 at the Washington State Convention & Trade Center.

Your registration packet including, badge, final program, tickets, and portfolio will be waiting for you at the registration counter located at the Washington State Convention & Trade Center.

2002

APSS 16TH ANNUAL MEETING

SEATTLE, WASHINGTON • JUNE 8-13, 2002



REGISTER ONLINE AT

WWW.APSS.ORG

KEYNOTE ADDRESS

Monday, June 10



David F. Dinges, Ph.D.

*"Manifestations Of Sleepiness:
What Does It Mean To Be Awake?"*

INVITED LECTURES

Albert J. Berger, Ph.D.

"Basic Hypoglossal Control"

Mary A. Carskadon, Ph.D.

"Regulation Of Sleep And Alertness In Adolescence"

Pierluigi Gambetti, M.D.

"Genetics Of FFI And sFI"

Martha U. Gillette, Ph.D.

"Cellular Mechanisms In Neuronal Timekeeping"

J. Christian Gillin, M.D.

"Functional Imaging Related To Sleep"

Adrian R. Morrison, D.V.M., Ph.D.

"Ideas, Behavior, And REM Sleep"

Nelson B. Powell, D.D.S., M.D.

*"Upper Airway Surgery In The Treatment Of Obstructive
Sleep Apnea"*

Jerome Siegel, Ph.D.

*"Hypocretin (Orexin): Normal Role And Contribution To
Narcolepsy"*

Giulio Tononi, M.D., Ph.D.

"A Neural Theory Of Consciousness"

more than two authors should be cited as Pereira et al., 1998. Authors should be listed in alphabetical order.

Examples of references:

Paper

Timo-Iaria, C., Negrão, N., Schmidek, W.R., Hoshino, K., Lobato de Menezes, C.E. and Leme da Rocha, T. Phases and states of sleep in the rat. *Physiol. Behav.*, 5: 1057-1062, 1971.

Book

Kleitman, N. Sleep and wakefulness. Chicago, University of Chicago Press, 1963.

Book Chapter

Webb, W.B. Theories about sleep and some clinical implications. In: Drucker-Colin, R., Shkurovich, M. & Sterman, M.B. (Eds) *The functions of Sleep*. New York, Academic Press, 1979, 19-36.

- Illustrations and Tables: Should be referred in the text in Arabic numbers, e.g., Figure 1, Figure 2, Table 1, etc in order in which they appear. Each figure must be marked on the back with the appropriate number, name of the corresponding author and first words of the title. In case there are doubts about the orientation of the figure, mark the top. Photographs should be sent in glossy paper. Color illustrations will be

accepted as long as the author(s) contribute towards the further cost of printing. Each figure should have a clear and informative legend (including symbols for statistical differences). Remember that figure + legend must be sufficient for the reader to understand most of the study. All figure legends should be typed on a separate page.

Tables should contain only essential data. They should be presented on a separate page numbered in consecutive Arabic numerals and containing a concise, but informative caption.

- Units: Measurements must be in SI units. For instance, cm for centimeter, l for liter, min for minutes, etc.
- Informed Consent/Ethics of Experimentation: Experimental studies in humans must specify that the research received prior approval by the institutional Ethics Committee and that informed consent was obtained from each subject of patient. Manuscript describing investigations in animals must clearly indicate the steps take to eliminate suffering and pain. These should also be approved by the Institution's Ethics Committee and be in accordance to the Principles of Laboratory Animal Care (NIH).

Student's BITS— Brief Insights for Training in Sleep

As a reminder, Student BITS is a forum for trainees - so if you have something to communicate please forward it to me at smdoran@mail.med.upenn.edu. Remember, you are a trainee from the first day of class until the day they give you the keys to your own lab. Your unique sleep training experience and/or perspective is sure to be a delight to your fellow SRS members.

Sleep Research Society Committees and Task Forces: Mechanisms for Trainee Action

The purpose of the SRS is easy to understand: to promote sleep research, help train sleep researchers, and communicate the results of sleep research. SRS goals are clear from the mission statement but the process the SRS uses to reach these goals is not so easy to understand. My experience as trainee representative has helped me appreciate how the SRS functions to meet its goals. Understanding how our society functions is important to trainees because we will inherit both the results of SRS efforts and the administrative structure by which we meet the goals of our society.

The SRS is a non-profit organization administrated by a board of directors. The board consists of 12 SRS members privileged to vote on important issues like how to use our \$1.4 million budget and how to fairly represent 825 members, 250 of whom are trainees. The 12 members of the board include 4 section heads, the chairs of 3 standing committees (Membership, Training and Education Advisory Committee (TEAC), and Publications), the 3 presidents (current, president-elect, and past president), the secre-

tary-treasurer, and the trainee representative. Each sitting board member is there because they represent the specific interests of a sub-section of the SRS membership (except for the 3 presidents and the secretary treasurer who represent the membership as a whole). As trainee representative I evaluate all board actions considering the best interests of the trainees. That means I always vote to increase funding for trainee programs and I try to get new programs to include trainees. The 4 section heads represent the research interests of their section; Basic Sleep, Sleep & Behavior, Circadian Rhythms, and Excessive Daytime Sleepiness. When you joined the SRS you selected one these 4 sections on your application form. The head of your section works to assure that all board decisions are fair to the researchers in your topic area.

Decisions of the board represent the official voice of American sleep research so these decisions have significant political and economic implications. For example, the board sends SRS members with official mandates to Washington D.C. to participate in NIH forums with public policy makers and present mandates from the SRS. This accomplishes the SRS goal to disseminate state of the art sleep knowledge and helps direct federal money into the most deserving areas of sleep research and related public policy making. Such responsibility puts enormous power in the hands of the board. To assure the board stays connected with the SRS membership, SRS bylaws call for a network of committees and task forces designed to bring more of the membership into the decision making process.

The administrative board meets 2-3 times a year and has a conference call every month to evaluate initiatives requesting money, effort, or representation from the SRS. Initiatives that comprise a typical monthly board agenda come from groups within the SRS, from other scientific societies, or from professional organizations. Because these initiatives set the monthly agenda of the board, working on committees to draft the initiatives is a very powerful way for trainees to contribute to the SRS. There are two classes of committees open to trainees. Standing committees have been designated by the SRS bylaws as vital to the long-term goals of the SRS and they will persist as active committees until voted out of SRS by-laws by a majority of SRS members. Ad hoc committees are those formed to respond to new or emerging needs of the SRS but are not (yet) mandated in the SRS bylaws. The work of ad hoc committees is no less important than standing committees. In fact, if the work of an ad hoc committee can ultimately be deemed important enough to the long-term goals of the SRS to be elevated to standing committee status by a vote of the membership.

The standing committees include The Awards Committee that evaluates and nominates scientists for all the SRS awards. The Committee on Animal Research Ethics (CARE) develops animal research policies with respect to the unique needs of sleep research. CARE is important to trainees because the constant evolution of techniques and federal policies means that SRS animal care policies must change with the times. CARE is responsible for both developing sleep research specific standards of practice and defending those practices to detractors. This committee needs members with both scientific and political interests. The Membership Committee keeps track of current members and their section status while working to increase the number of SRS members. Trainees across disciplines have a lot to offer the membership committee in the form of new ideas for recruiting and retaining student members. TEAC oversees APSS Trainee Day and evaluates other proposals requesting SRS funds for sleep research training. For example, the board approved \$25,000 for a trainee event at the upcoming Society for Biological Rhythms Research meeting in May. Trainees who wish to develop programs designed to improve trainee skills are strongly encouraged to join TEAC. The Publications Committee is responsible for the SRS bulletin and participates (with the American Association of Sleep Medicine (AASM)) to produce the journal *Sleep*. Because most of the SRS publications will become available on the web service the mandate of this committee is likely to expand. Trainees interested in web publication will find many new challenges by working with the Publications Committee.

Ad hoc committees include the Government Affairs Committee intended to coordinate SRS relationships with the government and with other groups increasing the visibility of sleep research. Although trainees are not allowed to go Washington D.C. and represent the SRS to policy makers, we can be on the Government Affairs Committee to develop mandates our representatives communicate to public policy makers. The Web Services Committee was developed to create the new SRS website and the vision of what our web site will offer both SRS members and the public continues so expand. It is likely that this committee will either become a standing committee or will merge with the publications

committee. The Junior Faculty Development Committee was designed to coordinate the creation of SRS endowed sleep research faculty positions. The first position was granted to Washington State University and now this committee oversees the recruitment, hiring, and spending of the junior faculty development funds. The Education and Scientific Review Committee is supposed to develop and/or review any sleep research training proposals beyond those covered by TEAC for new sleep researchers. While the idea is a good one I am not aware of the scope of initiatives under development by this committee. The International Outreach Program Committee assists financially disadvantaged sleep researchers from outside the United States. Members of this committee have a budget they can use to help financially disadvantaged foreign sleep researchers attend the APSS meeting and other SRS sanctioned events.

Not all committees are open to trainees. Only current board members can sit on the Budget, Nominating, APSS Program, Joint Operating, and Executive committees. These committees create a yearly budget, nominate members for election to presidency and stage the yearly APSS meeting in collaboration with the AASM. These tasks require the historical knowledge held by established SRS members.

Task forces are groups of SRS member volunteers who join their efforts to deal with more immediate needs of SRS. The board will typically assign a task force to a single item of business. For example, a task force was recently formed to determine if money spent for trainee events like the APSS Trainee Day and the Lake Arrowhead meeting is effective for retaining young sleep researchers. I am pleased to say that the initial work of that task force found that trainees who received SRS money continued to participate in the SRS at a high rate as measured by the number of sleep papers and sleep meeting abstracts they produced. The Trainee Benevolent Fund Task Force is a group charged with soliciting contributions for as of yet undeveloped trainee programs. The Semi-Centennial of REM Sleep Task Force is very active right now putting together ways to celebrate the 50th anniversary of the discovery of REM sleep in 2003. This task force is planning for events and publicity surrounding the 2003 APSS meeting in Chicago and they are actively soliciting new ideas. If you have a good idea regarding how to celebrate the discovery of REM sleep please share it with this task force.

Every month there are new proposals that receive funding, task forces formed, and legislation accepted according to the vote of the administrative board. These votes fairly represent all SRS members only because they are the last of many efforts required to bring change to the SRS. Committee and task force work is important because it assures that our society is shaped according to the collective efforts of the membership. SRS trainees are the eventual recipients of committee initiatives and board decisions made today. Trainee participation on SRS committees and task forces is essential to our small society because we comprise almost one-third of the membership. Your contribution of time and ideas today will help shape the SRS we will inherit.

calendar of events

May 2002

Association Name	Meeting Name	Dates	Location
Sleep Research Society	Board of Directors Meeting	May 2	Conference Call
National Heart Lung and Blood Institute	Advisory Council Meeting	May 9-10	NIH
National Institute of Mental Health	Advisory Council Meeting	May 9-10	NIH
American Thoracic Society	International Conference	May 17-22	Atlanta, GA
National Institute on Aging	Advisory Council Meeting	May 21-22	NIH
National Institute on Nursing Research	Advisory Council Meeting	May 21-22	NIH
National Institute Drug Abuse	Advisory Council Meeting	May 22-23	NIH
Society for Research on Biological Rhythms	Annual Meeting	May 22-26	Amelia Island Plantation, Jacksonville, FL

June 2002

Association Name	Meeting Name	Dates	Location
National Institute of Child Health and Development	Advisory Council Meeting	June 3-4	NIH
European Sleep Research Society	Congress	June 3-7	Reykjavik, Iceland
National Institute on Alcohol Abuse & Alcoholism	Advisory Council Meeting	June 6	NIH
Academy of Dental SleepMedicine	Annual Meeting	June 6-9	Seattle, WA
Associated Professional Sleep Societies	Annual Meeting	June 8-13	Seattle, WA
Association of Polysomnographic Technologists	Annual Meeting	June 9-12	Seattle, WA
American Medical Association	Annual Meeting of the House of Delegates	June 16-20	Chicago, IL

ANNOUNCEMENTS

CALL FOR NOMINATIONS: 2003-2004 SLEEP RESEARCH SOCIETY TRAINEE MEMBER-AT-LARGE

Dear Colleagues:

It is time to elect the 2002-2003 Sleep Research Society Trainee Member-at-Large (a.k.a. Trainee Representative). The current duties of the Trainee Representative include participating in the monthly SRS board of directors conference calls, chairing the APSS Trainee Day Program Committee, and managing the Sleep Trainee Email Network (T-Net). The stated function of the Trainee Rep. is to be the liaison between the SRS board of directors and the ~250 SRS trainee members. Only your imagination, effort, and the votes of the SRS board limit this responsibility.

The position of SRS Trainee Member-at-large requires a two-year commitment. Jennifer Martin, who was elected last spring, will actively hold office from this year's APSS Meeting until the APSS Meeting in 2003. The next Representative will hold office from the APSS meeting in 2003 until the APSS meeting in 2004. The first year constitutes an informal "training period" prior to holding office during which the newly-elected Representative can work closely with Jennifer to become familiar with the SRS Trainee Representative position. Since elected Trainee Representative, I have spent an average of 6 hours per week in this capacity with large week-to-week variability.

The election process will be the same as in past years. Each self-nominated candidate will submit a statement (400 words or less), containing whatever information the candidate wishes to express to the voters (e.g., reasons for wanting to be the SRS Trainee Representative, goals for his/her tenure, etc.). The statements will be compiled into a ballot, which will be sent to all dues-paying trainee members of the SRS for voting. If you would like to be a candidate for this position, please send me, either via email or a fax, your ballot statement. Candidate statements must be received by May 15, 2002.

Sincerely,

Scott Doran

2001-2002 SRS Trainee Representative

Laboratory for Neuromodulation and Behavior, University of Pennsylvania School of Medicine, VAMC (151) Room 520, Philadelphia, PA 19104, Tel: (215) 573-5204, Fax: (215) 573-5202; Email: smdoran@mail.med.upenn.edu

CALL FOR CLASSIC PAPERS

In recognition of the necessity of current sleep researchers to know the history of our field, the Sleep Research Society is launching an initiative to make classic sleep research papers available electronically via www.sleepresearchsociety.org. Due to copyright issues, we are currently requesting that members send to the SRS sleep papers published prior to 1928, and the papers should be those considered to be seminal to the formation and advancement of the sleep field.

The preferred format for submissions is .pdf, however, we will also accept quality photocopies by mail, which we will scan to electronic

form. Send electronic copies (.pdf) to acebo@brown.edu, and hard copies to The Sleep Research Society Classic Papers Project, 6301 Bandel Road, Suite 101, Rochester, MN 55901. To make a hard copy submission after July 1, 2002, please send to 1 Westbrook Corporate Center, Suite 920, Westchester, IL 60154. For more information, visit our website at www.sleepresearchsociety.org/resources/papers.php.

MAKE AN INVESTMENT IN THE FUTURE OF SLEEP RESEARCH

The Sleep Research Society has a number of programs that encourage sleep research and foster the growth of our field. We offer unprecedented trainee support, instituted a new international outreach program, and we have stepped up our participation in government affairs related to legislation affecting the field. The J. Christian Gillin Junior Faculty Development Program supports a junior faculty appointment at a selected institution for a period of three years. This program is currently in its inaugural year, and it is our hope that this and future appointments will assist deserving young researchers to launch their careers in sleep research.

Please consider giving your tax-deductible contribution to this or other deserving SRS programs. Please send your contributions to the SRS national office. Prior to July 1, please send to 6301 Bandel Road, Suite 101, Rochester, MN 55901; after July 1, please send to 1 Westbrook Corporate Center, Suite 920, Westchester, IL 60154. Call Lance Brink at 507-287-6006 for more information or questions.

CALL FOR CLUB HYPNOS PROPOSALS

Proposals for the Club Hypnos initiative of the Sleep Research Society are being requested. Proposals are due August 1, 2002 to be included into the 2003 budget. This initiative is being extended to include other society meetings. The Club Hypnos program is an SRS promotional initiative to benefit our members who routinely attend meetings of other professional scientific societies and to solicit new members. Club Hypnos events also spotlight the importance of sleep and sleep research at other societal meetings.

If you are interested in hosting a Club Hypnos event, please contact the national office for guidelines for submitting a proposal or visit the SRS website for further information. If you have any additional questions, please contact Dr. Jodi Mindell, Membership Chair, at (610) 660-1806 or via email at jmindell@sju.edu.

SRS GENERAL MEMBERSHIP MEETING AT THE APSS 16TH ANNUAL MEETING—SEATTLE, WASHINGTON

The SRS will have its General Membership Meeting on Tuesday, June 11, 2002 from 12:30 pm - 1:30pm located in Room 6D (WSCTC).

Sleep as restitution

– relation to metabolism, stress, nutrition and overall health

AUGUST 18 – 21 • 2002 IN STOCKHOLM • SWEDEN

ORGANISING COMMITTEE

Torbjörn Åkerstedt · IPM and Karolinska Institute · Stockholm ·
Peter Nilsson · University of Lund ·
Christer Edling · the Swedish Society of Medicine · Stockholm ·
the Royal Society of Medicine · London

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POSTDOCTORAL POSITIONS IN SLEEP AND ANESTHESIOLOGY RESEARCH AT THE UNIVERSITY OF MICHIGAN

- ✧ **Cholinergic mechanisms of arousal state control**
Helen A. Baghdoyan, Ph.D.
- ✧ **Functional imaging and computational EEG analysis in obstructive sleep apnea**
Ronald D. Chervin, M.D., Bruno J. Giordani, Ph.D., Nikola S. Suboti, Ph.D.
- ✧ **Sleep disruption in the critically ill**
Flavia Consens, M.D., Joyce Wahr, M.D.
- ✧ **CNS control of sleep, anesthesia, and breathing**
Ralph Lydic, Ph.D.
- ✧ **Effects of sleep and sleep disorders on epilepsy**
Beth A. Malow, M.D., M.S.
- ✧ **Stressor-induced alterations in sleep, neuroimmunology**
Mark R. Opp, Ph.D.
- ✧ **The role of REM sleep in development, learning and memory**
Gina Poe, Ph.D.

Environment:

- The sleep research community at the University of Michigan is composed of multiple laboratories in the departments of Anesthesiology and Neurology. There is ample opportunity to interact with neuroscientists and clinicians in the Departments of Anesthesiology, Pharmacology, Psychology, Psychiatry, and the Neuroscience Graduate Program.
- The University of Michigan Medical School ranks 8th nationally in grants from NIH with awards totalling \$213 million in fiscal year 2001.
- The University of Michigan is a diverse community with many cultural events including local and visiting artists, musicians, writers, and public figures, as well as museums, libraries, theaters, and the symphony.
- Ann Arbor is a picturesque city on the Huron river, with community parks, botanical gardens, and the Nichols Arboretum. Restaurants range from fine dining to local bars and grills. Festivals and special events occur year-around, and include internationally renowned events such as the Ann Arbor Art Fair, Ann Arbor Blues and Jazz Festival, and the Ann Arbor Folk Festival.

Applicants should send a cover letter stating area of interest and a copy of their CV to:
Ms. Anita English (734) 647-2602, apainter@umich.edu
University of Michigan, Department of Anesthesiology, 1150 West Medical Center Drive,
7433 Medical Science Building I, Ann Arbor, MI 48109-0615.

UNIVERSITY OF ROCHESTER MEDICAL CENTER
SLEEP RESEARCH LABORATORY

WORK AND TRAINING IN SLEEP RESEARCH AND SLEEP MEDICINE

**WE ARE CURRENTLY RECRUITING FOR A VARIETY OF
POSITIONS INCLUDING:**

- **2 Research Assistants / Technicians**
- **1 Clinical Trials Coordinator**
- **1 Clinical Research Fellow**
- **1-2 Jr. Faculty Members**

- **A graduate student slot may be arranged by request**
- **Clinical Psychology internships spots are available on an annual basis.**

ENVIRONMENT

- **Small sized and modestly well funded sleep research group**
- **Strong tradition of training & mentorship**
- **Career development minded**
- **User friendly department**
- **City with a good standard of living**
- **Many cultural & outdoor recreational opportunities**

RESEARCH FOCI

- **Neurobiology of Primary & Secondary Insomnia**
- **Neurocognitive factors in Primary Insomnia**
- **Sleep Disorders Clinical Trials Research**

- **REM abnormalities & Insomnia in MDD as risk factors for new onset and recurrent illness.**

For more information
please visit our web site:
www.urmc.rochester.edu/smd/psych



Contact Information

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