Sleep & Dreams

Table of Contents

President's Column 1
Editor's Column 2

Articles
David Foulkes
    A Contemporary Neurobiology of Dreaming? 2
John Antrobus
    Dream Theory 1997: Toward a Computational Neurocognitive Model 5
Nicholas Rosenlicht and Irwin Feinberg
    REM Sleep=Dreaming: Only a Dream 10

News and Comments
SRS Young Investigator Award
    Deadline: April 1, 1997 13
SRS Senior Investigator Award
    Deadline: April 25, 1997 13
SRS Training Manual 14
NIH Grant Announcement 14
2nd Congress of the Asian Sleep Research Society
    August 24-29, 1997, Jerusalem, Israel 15
11th Annual APSS Meeting
    June 10-15, 1997, San Francisco, CA 15
European Sleep Research Society Meeting
    September 9-12, 1998, Madrid, Spain 15
In Memorium 15

SRS Bulletin is on the Web
http://bisleep.medsch.ucla.edu/srs/publications.htm
President's Column

This is the time in which magazines and newsletters are full of predictions, so in that spirit I would like to contribute mine: this will not be a dull year for the SRS. We continue to go through a number of changes which began with the last 2 or 3 presidents, and which it might be helpful for us to review together. I will try to bring you up to date on them through this column, and am asking for your guidance. As I see it, the major movements of the last few years include:

1. Growing pains. In a number of areas, methods of doing things that worked well in a small organization may not be the best approaches in a larger one. Certainly one area in which this is the case is the management and documentation of our finances. We now have net assets in the general area of $600,000 and annual budgets exceeding $100,000. For this reason, we have been working since I was secretary/treasurer to develop more businesslike means of documenting our financial structure. Under Steve Henriksen's leadership, we have now completed our first formal independent accountant’s review for the year ending December 31, 1995, and we shall make this our standard procedure. A subsidiary result has been that the board needs more detailed and businesslike documentation of expenses and of outlays for services by related organizations.

2. We are not alone. More and more I am realizing that we do not operate in a vacuum. Our actions impact on, and are impacted by, those of the ASDA. Under Chris Gillin's leadership, the Joint Operations Committee (JOC) has become a stronger, more effective body for dealing with issues related to the annual meeting and to the journal Sleep. Certainly one of these issues is the best way to publish the APSS meeting abstracts starting in 1998. Should we continue with the longstanding tradition of having an annual Sleep Research volume, or should we opt for a new approach of publishing them in Sleep? At the time of this writing, we are in the process of mailing out a ballot to all the voting membership. Included with the ballot is a statement of the pros and cons of a very complex issue. It has ramifications for many different areas; indeed, it seemed to the Board to be too important to be decided just by the leadership, and we are asking for the judgment of the majority of the membership.

3. Merger with the ASDA? This issue, which Chris has vigorously pursued during his presidency, continues to be on the table. It seems to me that there are advantages and disadvantages to both sides. Talks between the officers of the two organizations continue, and we will try to keep you up to date, and certainly ultimately ask for your judgment. The only thought I would express at this point is that whether we merge or not, we must find ways to work closely together, and to
find ways of preserving the very special atmosphere and
history of the SRS.

4. Making things more democratic. Certainly
one major movement in this direction was begun with
the formation of the Section system during Tom Roth's
presidency. By having the section heads form the first
layer of the officer nomination process, the hope is to
make the choosing of our officers more truly responsive
to the overall membership. The forthcoming vote on
the method of publishing APSS abstracts is another step
in our efforts to be more democratic. The common
activity we all share—participation in scientific
research—is not one which lends itself to following the
authority of the few, but rather comes from the
judgment of all involved in the process. It seems to me
that this should apply to the management of scientific
organizations as well.

Finally, it is important not to lose sight of our
goal: developing and disseminating new knowledge
about sleep, in all its many aspects. As we work
together on the many changes ahead of us, I believe the
gold standard should be whether any particular policy
helps us achieve this goal.

Editor's Column

The focus on dreams was prompted by a recent study in
Nature (Maquet P, Peters J, Aerts J, Delicop G,
Deguelde C, Luxen A, Franck G. Functional
neuroanatomy of human rapid-eye-movement sleep and
used positron emission tomography (PET scan) to study
the brain during REM sleep. They found that the
amygdala (among other areas) was activated during
REM sleep. The authors concluded that because the
amygdala is involved in processing emotion and fear
their findings show the biological basis of the emotional
processing during dreaming.

Twenty years ago the paper by Hobson and McCarley
(The brain as a dream state generator: An activation-
synthesis hypothesis of the dream process. American
intense debate. The question whether dreaming can be
described simply as activation of neurons is still with
us. In fact, the very concept of consciousness itself is
being investigated using electrophysiological measures.

In this issue we invited researchers who have devoted
their life to studying dreams to discuss the subject. Dr.
Earnest Hartmann’s contribution arrived as this issue
was going to press and so will be published in the next
issue. As usual, please direct any comments to the
editor.

Articles

A Contemporary Neurobiology of Dreaming?

David Foulkes

Dr. Shiromani’s choice of dreaming as the topic here
was, he indicates in a letter to participants, "prompted
by a recent article in Nature which found that during
REM sleep the amygdala showed increased blood flow
in human subjects. National Public Radio and others
picked up the story that this shows the basis for the
emotional content in dreams."

There is much in this episode that captures the
essence of what has come to be known as the
neurobiology of dreaming: spurious claims quickly
broadcast both to other neuroscientists and to the
general public, each apparently totally credulous when
it comes to neuroscientific "breakthroughs" in

understanding dreaming. Neuroscientists seem to want
to believe that current work in their disciplines can
produce immediate insights into complex human
cognitive processes. The general public evidently
wants to believe that a real (i.e., nonpsychological)
science of dreaming has replaced a century of
increasingly far-fetched clinical mumbo-jumbo.

When some of us who still attempt to understand
dreaming psychologically demur at the immediate
prospect of a neurobiology of dreaming, this generally
is seen as the dying cry of humanistic souls who will
never admit the reduction of any human
accomplishment to mere biology (or chemistry or
If dreaming is merely the operation of consciousness in these cognitive/neural conditions, then the very search for a distinctive mechanism for dreaming may be mistaken. REM sleep may best provide the conditions, but consciousness under these conditions is probably doing precisely the same job as it does in wakefulness: coherently but faithfully summarizing information currently active or available. That is, the mechanism of dreaming probably is the mechanism of consciousness more generally, operating under these conditions.

Neurobiological theories in the present era also are heavily invested in deducing the formal properties and the specific content of dreaming from subcortical stimuli. That is, they see the dream as having its sources in cognitively primitive systems, which constitutes, I suppose, a sort of neuroscientific variant of Freudianism. One suspects that the more available research access to cognitively primitive systems, rather than their inherent significance, has something to do with this emphasis. Now it is true that, during REM sleep, as during waking, there is intensive activation of cortical structures by brainstem systems. But there is absolutely no evidence that the REM-sleep activation carries any kind of psychological information upstream that is in any way determinative of dream form or content, and there is good evidence to suggest that dreaming is in no way dependent on such primitive forms of putative subcortical information.

In the neurobiological mindset, the dream is passive: it reflects, even as it labors to interpret, sources outside of the mind itself. In this respect also, contemporary dream neurobiology is very much like Freud, as well as like those many 19th century theorists who saw dreaming as the perceptual interpretation of events arising—in the world or in the dreamer's own body—outside of the dreamer's mind.

But, as Vogel (1978) has pointed out, there is another way of interpreting the role of subcortical structures in promoting cortical arousal during REM sleep. These structures simply turn on the light switch upstairs. They don't tell any of the creatures upstairs what to do or how to do it; they simply arouse them, enabling them to do whatever it is that they characteristically do. This is the general interpretation of the role of brain-stem initiated cortical arousal in waking, where no one seriously believes that the form or substance of conscious ideation is determined by the pons, and there is no physiological evidence that REM and waking cortical arousal are in any important respect functionally different from one another (Steriade, 1996). In this alternative model, the cognitive system determines its own dream, and the kind of dream that can be dreamed is related to the maturity of the cognitive system itself, not to any of its supposed more primitive sources.

Empirical evidence for this alternative comes from two sources: (1) human neuropsychology, which has established that dreaming is coextensive not with
perceptual competence but with competence in mental imaging, a relatively late cognitive acquisition (see Kerr, 1993); (2) sleep-laboratory studies of children's dreaming, which indicate that dreaming is absent until ages 3 to 5, and does not assume the form of adult dreaming until ages 7 or 8 (see Foulkes, 1993b). The evidence on cross-state dreaming reviewed earlier indicates that REM sleep is not a necessary condition of dreaming. The evidence just mentioned indicates that REM sleep is not a sufficient condition of dreaming. You can have all the brainstem arousal of the REM-sleep cortex imaginable, but not until, or unless, there's a certain kind of mind in that cortex, will there be any dreaming. It's not the properties of the downstairs arouser that determine if there will be a dream or what kind of dream there will be; rather, it's the properties of the upstairs aroused that serve this function. In psychological terms, there has to be a mind capable of conscious representational and self-representational intelligence for full-fledged dreaming to occur, and that sort of mind does not seem to be in place until ages 7 or 8.

Thus, based on substantial and replicable psychological and psychophysiological data, I find current neurobiological models of dreaming to be wholly inadequate, and, what is even worse, to be diverting attention from the real issues in a possible neurobiology of dreaming. That these issues are complex is shown by the observation of interrelations among the phenomena of dreaming, waking consciousness, and waking cognition. These issues simply can't be addressed with such indefensible notions as REM=dreaming or subcortical determination of dream form and content.

Which brings me back to Dr. Shiromani's citation of the recent fuss about the amygdala and dream emotion. If one has a mind capable of weaving complex stories about diverse sources—in whatever state—then these stories often may have emotional accompaniments, because that's inherent in story making, and because feelings are as cognitive a process as the story making itself. One doesn't need to be in REM sleep to have such emotions; indeed, intense anger or sexual arousal may accompany daytime fantasies. It's the quality of the mind that's important, not the state in which that mind is active.

It does not seem likely that any particular blips or surges in the limbic system would be needed to "cause" these feelings, although they might—or might not—ultimately become accompaniments of them. The feeling is caused by narrative necessity, which is why it generally is appropriate to the immediate narrative context of the unfolding dream scenario (Foulkes, Sullivan, Kerr, & Brown, 1988). I wouldn't want to deny that conscious imagination or narrative necessity themselves do indeed have physical bases, but I doubt that they are to be found either in the brainstem of the cat or in the human amygdala.

Thus, I am no more impressed by the breakthrough discovery of a noncognitive, subcortical, REM-only source of dream emotions than I have been with other recently-claimed neurobiological breakthroughs in understanding dreaming using the same assumptions. A plausible neurobiology of dreaming may emerge only when neuroscientists begin to interest themselves in the empirical data of dream psychology, and thus begin to understand just how immense a task it will be to explain conscious representational intelligence in its cross-state dreaming form.

References

Dreaming is an experience that has fascinated people at least since the beginning of recorded history. Although we have made substantial gains in the last 45 years in understanding the process of dreaming our current models undoubtedly are only rough approximations of the form that a satisfactory comprehensive model of dream will be will ultimately take. Our ability to construct a satisfactory model depends, in my judgment, on our ability to relinquish two erroneous assumptions about dreaming. The first, promoted rather dogmatically by Sigmund Freud and his followers, is that the process of dreaming is already well understood. Indeed, psychoanalysis has given the study of dreaming such a bad reputation, that many scientists are reluctant to be associated with the field. The second unfortunate but common assumption is that dreaming can be studied as an isolated science, independent of cognitive and biological science and without the aid of complex computational models.

I have argued elsewhere (Antrobus, 1991, 1993) that, beginning with Aristotle, every significant advance in the understanding of dreaming has depended fundamentally upon the discoveries, theories and models of our neighboring sciences, particular those we now label cognitive psychology and cognitive neuroscience, and more recently computational science. The discovery by Aserinsky and Kleitman (1953) of the association between dreaming imagery and thought and the periodic physiological state, Stage 1 REM (rapid eye movements), led to an intense period of psychophysiological research that attempted to isolate the exact physiological markers of the dream state. But the paradoxical relation between the cognitively active state implied by reported dreaming and the waking-like EEG and REM indices on the one hand, and the coma-like EMG and motor states on the other could not be explained solely on the basis of information obtained during the sleep state.

It was Hobson and McCarley (1977) who solved the riddle by showing that most of the physiological and cognitive characteristics of REM sleep were associated with the same brainstem physiological control system that activates body and mind in the waking state - namely the ascending reticular activating system (ARAS) previously discovered by Moruzzi and Magoun (1949). But in REM sleep a neighboring set of nuclei actively inhibit sensory input and motor output. Together, these two brainstem processes explain how dreaming might plausibly be attributed to the activity of an active brain bereft of sensory input - including proprioceptive input - that the brain normally receives in the waking state as a consequence of its motor commands (Hobson, Lydic & Baghdoyan, 1986). Thus dreaming that one is unable to execute rapid movements such as running, might well be the consequence of brain stem inhibition of both motor outflow and proprioceptive feedback - rather than the symbolic representation of a deep personality conflict about the dreamer's personal development.

In acknowledging Hobson & McCarley's solution to the paradoxical activation problem in sleep and its implications for dreaming, it is important that we recognize its broad debt to research in neurophysiology and to research in the waking state - a debt that is now also our debt. But we must, in addition, take note of the long inference chains by which their model links sensory-motor activity in the waking state to the ARAS (Moruzzi, et al., 1949) to brain stem activation in the REM sleep of the cat to REM sleep in humans and dreaming. Our debt to neurophysiology will continue to grow as measurement techniques become more accurate and less invasive. For example, recent PET research by Hong, Gillin, Dow, Wu, & Buchsbaum (1995) on the activation of the frontal eye field regions during waking and REM sleep REMs has supported the dreaming-to-eye movement control system that I proposed in 1990, but the state of the art at that time did not permit it to be tested on human subjects.

Dreaming as State-Specific Process of a General Theory of Neurocognition

The dependency of dream theory on waking research is even more fundamental. Because our understanding of the relations between mental and neural processes is best expressed in waking cognitive and neurocognitive models of perception and thought the theory of dreaming must be expressed in terms of the concepts and processes of these waking models (Antrobus, 1991). For an extended argument for this assumption, see Kosslyn's recent book (1994) on waking visual imagery. Like waking visual imagery, dream imagery: form, color, movement and meaning, are produced only because the neural pathways and brain regions that have evolved to support waking perception, and because the patterns that an individual has learned in the waking state that permit him/her to make use of past waking experience - learned categories and events, exist in the neural architecture and networks. During REM sleep, given sufficient diffuse activation, these neural structures that
participate as processors in waking perception produce the images and thoughts that we call dreaming - whose characteristics are similar to those of waking perception. It follows that our understanding as scientists of the structures and processes of dreaming is completely dependent upon knowledge obtained through waking research, and in addition, on the comparison of relevant sleep and waking processes. From this perspective, a neurocognitive theory of dreaming should be constructed as part of a general theory of neurocognition rather than as a special independent theory.

Unfortunately, we are a long way away from a general theory of perception and cognition. Therefore, we have no alternative but to develop the theory of dreaming in parallel alongside the more rapidly developing theories of perception and cognition. It is the expansion of research and theory in cognitive neuroscience that is increasing the opportunities for such collaborative development. Specifically, the advances in locating neural regions that mediate the input-output processes of waking perception, and the ability to compare the role of these regions when there is no sensory input - as during imagery processing - make it possible for us to analyze dreaming processes in quasi-modular units rather than in vague, arbitrarily defined mediating processes. But the value of identifying these processing neural locations will reach a limit, unless it is accompanied by computational models of the hypothesized processes.

**Interdisciplinary Approaches**

These advances, have not been accomplished by psychologists alone, but by research teams that include neuropsychologists and other neuroscientists, computer scientists, physicists and mathematicians. Our understanding of dreaming processes in the past several years has improved only as sleep scientists have joined these eclectic teams. Kosslyn's work on waking visual imagery is an excellent example of this broad integrative theoretical work. But one must be careful about transporting his model into a model of dreaming. In much of his research, visual imagery is elicited by verbal instructions, and therefore are preceded by a verbal-meaning representation. The visual image in dreaming cannot be so easily manipulated in the sleeping subject. In my opinion, the visual image in dreaming does not have a single point source, but rather a broadly distributed family of origins.

As dream scientists join the cross-disciplinary teams that study perception and cognition, I would like to hope that the benefits will flow in both directions - that is, that research on sleep imagery and thought will contribute to the understanding of waking perception. For example, models of waking perception implicitly assume that, in the absence of the external visual stimulus, the brain cannot construct the perceptual image. Obviously, if this were true, REM sleep visual images could not occur. Not only do they occur, but they can be quite strong and the image strength can be calibrated against waking perceptual images. Using Steven's magnitude estimation technique to scale the subjective clarity and brightness of dream images relative to a waking standard of 100, we found that REM images were about 60% as bright and 57% as clear as a waking perceptual images (Antrobus, Kondo, Rensel, & Fein, 1995). When we keep the subjects asleep three hours beyond their normal waking times, REM image brightness and clarity increased to about 80% and 74% respectively of the waking value. The elaborate detail of some REM imagery illustrates the ability of the perceptual system to construct quality "perceptual" output with no sensory input. If the brain is able to produce such strong images in the absence of sensory input, and it does so in REM sleep by using some of the neural apparatus that is employed in waking perception, then perhaps the processes of waking perception are similarly less constrained by external sensory input than we usually assume.

At this point in time we do not have a good understanding of how the brain carries out these two processes. From one perspective, waking perception occurs when sensory input induces the perceptual networks to override their "spontaneous" internally-produced images and gives higher priority, i.e., "attends to," the analysis of sensory input. Indeed, Perky (1910) and Segal (1971), using a signal detection model showed how waking visual images can actually interfere with the perception of a visual stimulus.

Recently (Antrobus, 1994), I pointed out that a fundamental characteristic of waking perception is anticipation or prediction. Anticipation makes use of previously learned sequences of events in order to estimate the probabilities of future event sequences. The higher the estimated projections, the more the perceptual system is free to go "off-line" and use its resources for other tasks. When off-line, the learned expectancies can produce images of what is expected and may not come back on-line unless or until those expectations are violated. I suggested that these learned expectancies are the dynamic building blocks that are used in REM sleep to construct the dream sequence. The probabilistic character of these learned dynamic units gives the dream both a sequential coherence as well as sufficient novelty to make it seem almost like a real perceptual event. Without such learned dynamic units, dreams would be confined to static images.

**REM Sleep Physiology and Dreaming**

When an association between a particular set of experiential characteristics and a pattern of neural activity occur in both waking and sleep it seems reasonable to hypothesize that a similar neurocognitive process is occurring in both states. But it is much more difficult to interpret neural processes in REM sleep that do not correspond to any sensory input or neural
process that mediates sensory and conscious perceptual process or motor response pattern in the waking state. As discussed earlier, the similarities between the brain stem activation pattern in REM sleep described by Hobson et al. (1977) and the waking ARAS described by Moruzzi et al. (1949) were readily accepted by sleep scientists, as were the inhibitory processes that distinguish REM sleep from waking, even before there were any systematic studies of the model's implications for dreaming. We have carried out several experiments that strongly support the functional link between brain activation and dreaming (Antrobus, 1991; Antrobus et al., 1995). But we have found no support (Reinsel, Antrobus, & Wollman, 1992; Wollman & Antrobus, 1986) for the role posited by the Hobson et al. for PGO spikes - which have no corresponding role in the waking state. Recently, Hobson and Mamelak (1989) have proposed additional models for neural patterns in REM sleep that do not correspond to any waking patterns. They claim that these altered neural patterns describe the neural basis of bizarre REM imagery.

Although these models are eminently plausible they depend on a set of assumptions about the relation between a class of single unit neural activity (in the cat) and cognitive processes in the human that are highly speculative. We know relatively little about the relation between the higher level perceptual and cognitive processes and single unit neural activity in the participating brain structures. We can describe only a tiny fraction of the activity in the $10^{11}$ neurons in the brain in two different cognitive states - in this case, waking and REM sleep. Differences in neural activity between the two states imply a local difference in neural computation or information processing. Because REM dreams are somewhat more bizarre than waking thought, it is reasonable to suggest that because the REM activity differs from that of the waking state, the altered neural activity must account for the bizarre mentation of dreaming. This is particularly plausible in the case of the PGO-bizarreness hypothesis because the high voltage of the spikes might reasonably be expected, like the larger spikes of a grand mal seizure, to disrupt other ongoing neural processing.

Not surprisingly, the highly technical nature of these neurophysiological studies implies for some readers that the hypothesized relation between neural activity in the (cat's) brain and human dreaming is as solid as the neurophysiological results themselves. Clearly, dream scientists need to become sufficiently familiar with neurophysiology so that they can determine what points in the inferential process are most in need of empirical test, and then proceed to test them. As stated earlier, it is those neural processes in REM sleep that differ from the waking state that must be examined most critically. And it is not the responsibility of the neurophysiologist to experimentally evaluate every step in an entire neurocognitive model of dreaming. The task must be shared by the different investigators who are best trained to evaluate the separate parts.

Neural Network Models

The next, and more difficult problem arises when we find several neural process that are associated in time with a cognitive/imaginable characteristic of REM sleep. How do we determine which are the responsible processes, or if several participate, what is the nature of their interaction? This problem is a fundamental characteristic of complex processes. And while it is characteristic of cognitive processes within the waking state it is even more acute in the sleep state because of the special constraints on data acquisition. Translating models of waking cognitive processes to models of REM sleep cognition is the best means of building a model of dreaming, but the translation complicates an already complicated model. The only possible solution is to represent the processes in a computer model and see if the model behaves like the processes it is supposed to represent.

The most promising means of studying the neurocognitive processes of waking perception and REM dreaming at this time is with neural networks models. One of the many merits of neural networks is their ability to simulate the cognitive process of constructing a schema - a complex image that is the integration of many sub-schemata that are themselves schematic representations of integrated sets of micro-schemata or features (See Rumelhart, Smolensky & Hinton, 1986). Schemata are based on the learned connections among the most elementary units - artificial neurons - or sets of neurons that might represent micro-features. Once the connections are learned, the full set of units that represent a particular schema, e.g., a kitchen, can be elicited by activating different sets of artificial neurons, even by a small fraction of those that were presented on any of the original learning trials. Further, because of the large number of relations that can be represented by the artificial neurons in a single network, many different schemata can be constructed in a single network. Under certain input conditions, a network may construct a schema that is sufficiently different from any schema in the training set as to be called unique or "bizarre," yet completely coherent in the sense that its local featural relations are close to those in the training samples. For example, several nuns are riding in a car - but its color is fire engine red!

Although the schema model is a very simple neural network model, its ability to simulate so many characteristics of dreaming that were hitherto explained by a lot of vague hand waving and metaphors, suggests that more complex neural network models might be able to simulate even more characteristics of dreaming. As the simulations become more accurate they will - they already have - suggest new empirical studies that will in turn guide us in the design of even better models. In 1991 I described simulations of two fairly simple neural networks of dreaming. Recently, Hinton, Dayan, Frey and Neal (1995) and Dayan and Hinton (1996) have described a "wake-sleep" neural network

Page 7  
SRS Bulletin Vol 3, No 1, 1997
that uses both bottom-up and top-down connections that take into account the high ratio of top-down to bottom-up connections in the visual cortex. These models are still in the development phase however, and it will be some time before empirical REM and waking imagery data can be mapped onto these models.

I will briefly describe the characteristics of my DREAMIT-BP model (Antrobus, 1991) and then the Hinton et al., and Dayan et al. models. The DREAMIT-BP model was designed to simulate some characteristics of dreaming as an event sequence. Dreams are typically experienced as sequences of visual images and responses of the dreamer to those images. With some exceptions, the sequences reported from laboratory awakenings are remarkably lawful in that the probability of one event following the other is similar to that of waking life. The exceptions are the rather abrupt changes of scene identified in mentation reports by the preface, "and all of a sudden ...." Aside from these reported abrupt shifts, we know little about the basis for the apparent continuity of smaller sequences within the dream. The continuity could be achieved by small high probability shifts in visual images, or it could be "imposed" by facile cognitive interpretations of intermediate size shifts that obscure the discontinuities in those shifts. It is important to note that study of mentation continuity in the waking state under identical laboratory conditions shows that REM mentation has fewer, not more, discontinuities than waking mentation. We might assume that this difference is due to the greater control of waking thought sequences by associations of meaning whereas the control of REM sequences may be more strongly controlled by learned visual-temporal sequences.

Visual event sequences are learned as part of waking perception. They not only facilitate waking perception but they make possible the imagining of perceptual sequences in both waking and sleep imagination. Sequential information is learned within several sensory modalities and cortical locations and we may assume that waking and REM sleep imaginal sequences are produced by the coordinated action of the sequential information in these separate regions. For example, spatial sequences may be learned in the right parietal cortex, language, meaning and motor execution sequences in the left temporal and frontal lobes. We further assume that sequences are organized hierarchically so that, for example, the sequence of going to work controls sub-sequences of leaving the house, walking to transportation, riding to work, etc. and that each of these sub-sequences controls yet smaller sub-sequences of increasing finer structure and shorter duration. And we may assume that the predictability from one point to the next varies considerably depending on how invariant in the waking world are the steps in which the sequences were originally learned. Points of low predictability should have reduced ability to control the next image in an imaginal sequence. Indeed, one might expect abrupt changes of scene at such points.

To simulate this state of affairs, DREAMIT-BP (BP stands for the back propagation model of Rumelhart et al., 1986), was learned sequences of events in a simulated "waking" state, and its performance was observed in a simulated "sleep" state. A typical simulation consisted of a sequence of 24 events. The sequences were learned in et=i -> et=i+1 pairs so that the each et=i+1 was the et=i for the next event sequence. In the "sleep" state simulation, where there was no external sensory input to the model, DREAMIT-BP used as input the output of its own "imaginal" state. When the "waking" state learning was carried out to a high level of accuracy, seeding the model in the "sleep" state with any event, et=i, elicited each of the subsequent events in the learned chain, et=i+1, et=i+2, et=i+3 .... If the waking sequence was constructed so that the 24th event elicited the first event, then in the "sleep" state, the sequence would run as a continuous loop like a musical phrase that sometimes runs over and over in one's mind.

In order to observe the "dreaming" behavior of DREAMIT-BP where sequence predictability was low in the "waking" state we examined "imaginal" sequences where the learned sequence pairs, et=i -> et=i+1, were weaker than other parts of the chain. We also created some shorter training sequences of 6 or 12 events in which no "waking" event followed the last event in the sequence, and conversely no event predicted the first event in the sequence. In the "imagined" sequences, DREAMIT-BP produced events that were similar to those that had followed similar events in the learning phase. That is, if no event was learned in response to et=m, and if et=m was more similar to et=s than to any other event in the sequence, then in the imaginal phase et=m produced an event that was more similar to the event that had followed et=s, namely et=s+1, than to any other event in the learned set. The representation of et=s+1 tended to be poor in quality, bizarre if you will, but as the sequence moved from et=s+2 to et=s+3 the form quality was completely restored. The simulation was successful in showing that where no strong predictions were elicited by et=m, there was a high probability of a sudden break in the sequence. But while the next event might be called "bizarre," it was responsive to the similarities between et=m and other events in the learning history rather than being selected at random.

The ability of DREAMIT-BP to find its way back into a previously learned sequence is due to its ability to "find" one event in a previously learned sequence. The neural network back propagation model is a classification model. It is able to classify a variety of input patterns into one output category on the basis of the similarity of those input patterns to those in the learning set. This is exactly what must happen in the perceptual regions of the brain during REM sleep. Neural patterns that may be poor approximations to those of waking perception can nevertheless activate the previously learned pattern structures to which they
are most similar.

This conception of image production and recognition in dreaming sleep fits very nicely with the "dream incorporation" research of the 60s in which subjects who were stimulated by a water spray or sound of a bell produced dreams that interpreted the features of the external stimuli (see Antrobus, 1991). My experience with the simulation led me to pay attention to those parts of my own dreaming where I seemed to be trying to make sense of an ambiguous figure. That, in turn, took me back to the lab files of REM reports where I found a number of reports in which subjects explicitly referred to the process of trying to name or categorize an image that was clearly different from its closest neighbor in the waking state. One subject inferred that she must have been at the circus, because she was looking at a multi-sided table. Another inferred that his daughter must have banged her fingernail because it was flat. I realized that the standard method of elicited mentation reports in the lab encourages subjects to name the objects of their images but does not attempt to determine how good a member of the category class their image is.

This conception implies that dreaming, like waking perception, involves a hierarchy of "interpretive" brain regions ending in naming, meaning, and response production. But in waking, the very early sensory processing stages simply exert more constraint on the higher processes than they can in REM sleep where the sensory input is inhibited. In REM sleep, early perceptual process may similarly constrain the construction of visual images less strongly even though there is no sensory input. This assumes that a portion of dreaming is a bottom-up process. Clearly, if it were top-down, the name and meaning would be generated first, and the form would follow. In that case, the dreamer would not be surprised or uncertain about the category name of the image.

It is not the purpose of this paper to describe a more complete model of dream production. The DREAMIT-BP model is a fairly primitive model. It serves only to show that it is feasible to build a single cognitive model that, with minor alteration, can function in both waking perception and REM sleep. In so doing it helps us to realize how much we have yet to learn about the similarities and differences of these two states.

The Hinton et al. (1995) and Dayan et al. (1996) models are concerned with how the brain might create internal models of the external world. Although we typically conceive of visual perception as a bottom-up process, it has long been known that there are ten times as many top-down as bottom-up fibers in the visual cortex. The precise function of these fibers in perception is not understood. Hinton, Dayan and their colleagues compare the relative merits of a number of bottom-up and top-down models that might operate not only in perception, their "wake" phase, but in inducing the bottom-level representation of the external world, the "sleep" phase.

In the DREAMIT-BP model that I described above, the input and output are represented at the same level of abstraction. This use of the same code for input and output is perhaps reasonable for the presentation of sequences but not for the "recognition" of imaginal events that are represented in the visual-spatial code of waking visual perception. Sensory and perceptual processes involve massive reduction in dimensionality as the sensory input pattern is transformed and represented as a member of a lower dimensional category. Hinton, Dayan and their colleagues are concerned with how this bottom-up processes in waking perception is supported by parallel top-down processes and also with how, in the absence of external input, i.e., in their "sleep" phase, the top level representation can induce the representation of the external world that is created by the bottom layer of the system. Although their work in progress does not yet offer strong suggestions for a model of dreaming, it is clear that they are addressing issues that have fundamental significance for the relations between visual perception and the production of visual images and dreaming.

References


Evolving concepts of sleep cycle generation: From 
brain centers to neuronal populations. Behavioral 
and Brain Sciences, 9, 371-448.

a dream state generator: An activation- synthesis 
hypothesis of the dream process. American Journal 
of Psychiatry, 134, 1335-1348.

Hong, C. H., Gillian, J. C., Dow, B. M. & Buchsbaum, 
M. S. (1996). Localized and lateralized cerebral 
glucose metabolism associated with eye 
movements during REM sleep and wakefulness: a 
Positron emission tomography (PET) study. Sleep, 
18:570-580.

of the imagery debate. Cambridge, MA: MIT Press.

bizarreness as the cognitive correlate of altered 
neuronal behavior in REM sleep. Journal of 
Cognitive Neuroscience, 1, 201-222.

reticular formation and activation of the 
electroencephalogram. Electroencephalography 
and Clinical Neurophysiology, 1, 455-473.

Perky, C.W. (1910). An experimental study of 
imagination. American Journal of 
Psychology, 21, 422-452.

Bizarreness in sleep and waking mentation. In J. 
Antrobus, and M. Bertini, (Eds.). The 
neuropsychology of dreaming sleep. Hillsdale, 

Rumelhart, D. E., Smolensky, P., McClelland, J. L. & 
thought processes in PDP models. Pp. 7-57. In D. 
E. Rumelhart, & J. L. McClelland, (Eds.). 
Parallel distributed processing, vol. 2, Cambridge, 
MA: MIT Press.

Segal, S. J. (1971). Processing of the stimulus in 
imagery and perception. In S.J. Segal (Ed.) 
Imagery: Current Cognitive Approaches. (pp. 

Wollman, M.C., and Antrobus, J.S. (1986). Sleeping 
and waking thought: effects of external 
stimulation. Sleep, 9, 438-448.

REM Sleep = Dreaming: Only a Dream

Nicholas Rosenlicht and Irwin Feinberg
Department of Psychiatry, University of Medicine and Dentistry of New Jersey, 
671 Hoes Lane, Piscataway, NJ 08855 and 
University of California, Davis and VA Northern California Health Care System

There is an ironic contradiction in current 
literature on sleep and dreaming. Those who have 
conducted controlled research, or who have evaluated 
this research objectively, know that equating REM 
sleep with dreaming is no longer a supportable 
proposition - if it ever was. On the other hand, many 
neurophysiologists ignore the accumulated body of 
rigorous psychophysiological data and describe their 
research on REM sleep as studies of the 
"neuropsychology" or "biochemistry" of dreams.

Given the peculiar hierarchy of scientific 
authority, and the allure of linking psychology to 
physiology, it is these latter scientists that tend to 
dominate current opinion. This produces several 
unfortunate consequences. First, it suggests to our 
students that it is OK is ignore scientific data that does 
not fit one's prejudices. It also misleads the public on a 
topic of enormous lay interest. But its most destructive 
effect is to impede research progress: the daunting 
complexity of one of the most interesting problems in 
human brain-behavior relations is being sacrificed in 
favor of an outmoded (and false) simplification.

In the remainder of this brief essay, we outline the 
evidence that compellingly refutes a REM=dream 
isomorphism. A more detailed review will be published 
shortly.

Goodenough et al. (1959) appear to have been the 
first to seriously question the REM=dreaming 
equivalence. They reported that a group of subjects (Ss) 
who reported frequent spontaneous recall of dreams at 
home had a high (53%) rate of dream recall in 
experimental awakenings from NREM sleep. Three 
years later, Foulkes (1962) reported a similarly high 
(54%) rate of dream reports from NREM awakenings in 
Ss unsolicited with respect to dream recall. 
With reports of "thinking" included as dreams, this rate 
jumped to 74%, close to the ~80% usually obtained 
from REM awakenings. Foulkes did, however, find 
qualitative differences between REM and NREM 
dreams. Narratives from NREM awakenings tended to 
have a lower incidence of affective events and visual 
images than those from REM. This observation, which 
remains influential in textbooks and other literature, 
turned out to be misleading, as we discuss below.

Foulkes and Vogel's early study (1965) of mental 
activity at sleep onset further challenged the 
REM=dream equivalence. They found that dreamlike 
reports, often similar to those obtained from REM, 
could be obtained from awakenings at sleep onset. 
These reports were common during descending stage 1 
and 2, and could occur in the presence of alpha. 
Although the hypnagogic reports as a group tended to 
be shorter and to lack the visual continuity of many 
REM reports, they described -sleep onset narratives that 
seemed indistinguishable from the dreamlike reports
obtained from REM.

Early evidence cited in support of a REM=dream isomorphism was an apparent correlation between the pattern of rapid eye movements during REM sleep and that which would be expected if the subject had been scanning the dream images he later reported (Dement and Kleitman, 1957; Roffwarg et al., 1962). However, initial positive findings were not confirmed in later, better-controlled studies. Moskowitz and Berger (1969) found that only 18 of 56 blind matchings were correct, little above the fourteen expected by chance. Studies by Firth and Oswald (1975) and Jacobs et al. (1972) also failed to find a consistent relationship between eye movements and dream imagery. Koukaki (1972) reviewed the evidence on this question and concluded that "the notion of a constant isomorphic relationship [between eye movements and dream imagery] is untenable." Nevertheless, one still finds contemporary texts that describe the scanty hypothesis as confirmed. We would also like to reiterate here our hypothesis that the eye movements of REM hold no special significance for the psychology of this state. The effector response to neuronal firing in the oculomotor nuclei - eye movement - does not cause arousal. In contrast, it was concluded that REM discharges of motor neurons that control large muscles would awaken the sleeper were they not inhibited. Nature, being frugal, did not develop an unneeded inhibitory pathway to block eye movements. The biological significance of eye movement activity during REM probably lies elsewhere. Eye movement density appears to be roughly proportional to the within-sleep level of brain arousal. It could therefore provide a valuable non-invasive index of that important sleep variable (for details and some relevant data see Feinberg et al., 1987).

A REM=dream isomorphism also predicts that dream reports should be longer with longer periods of time in REM. A relation between narrative length and time in REM was reported by Dement and Kleitman in their pioneering study (1957). However, this early work did not mention control for time of night. Since REM periods are longer as sleep progresses it is probable that length of time in REM was confounded by time of night. A recent study (Rosenlicht et al., 1994) that included control for time of night did not find that narrative length was proportional to time spent in REM prior to the awakening. Mean total word count (TWC - a measure of dream length) in reports from awakenings after 10 minutes of REM sleep was not longer than after 5 min. However, mean TWC from REMP2 was almost twice that from REMP4, indicating that prior sleep duration is a much more potent determinant of narrative length than time in REM.

As it became evident that mental activity occurs in NREM sleep, some argued that REM dreams were qualitatively different because they were often more bizarre and affect laden. However, REM reports are usually longer than NREM reports. Therefore, when comparing the incidence of "dreamlike" events (visual images, discontinuities, etc.) in narratives from the two states, the length of the report must be taken into account. Antrobus (1983) demonstrated that when length of dream report, as measured by TRC (total recall count) is partitioned, the apparent qualitative differences between REM and NREM reports disappeared. A number of investigators including Foulkes and Schmidt (1983), Fein et al. (1985), Cavallero and Foulkes (1990), and Cavallero et al. (1992) have also shown that when length of dream report is controlled, there is little or no difference between REM and NREM reports. Thus, if narratives elicited by awakenings from REM have distinguishing features, these have yet to be demonstrated.

More recently, the mnemonic sources of dream content have been the subject of a number of interesting studies (Cavallero et al., 1990; Cavallero, 1987; Cipolli et al., 1988; Cicogna et al., 1986, 1991; Foulkes, 1982; Antrobus, 1987; Ehrlichman et al., 1985). Stage differences in dream recall appear more closely related to level of mnemonic activation and to access to memory traces than to any special dream production mechanism unique to one stage of sleep (Cicogna et al., 1986, 1991). Thus, Cipolli et. al. (1988) found that thematic units from different stages on the same night were more closely related than those from the same sleep stage on different nights. When Ss were asked to make associations to dream material, Cavallero and his colleagues (1987) found that mnemonic traces were similar for sleep onset and REM dreams. Finally, dream sources, as well as content, appear similar in REM and NREM mentation (Cavallero et al., 1990). In general, these results suggest that the same cognitive systems produce mental activity irrespective of EEG sleep stage, as Foulkes proposed in 1982. Moreover when Cicogna et al. (1986) compared memory traces from day dreaming and sleep onset dreaming, they found a similarity suggesting that "cognitive processes involved in the creation of original narrative sequences may be similar in sleep and waking."

We must, at last, explicitly reject the notion, as appealing as it may be, that REM sleep is the brain correlate of the dream. Sleep researchers, including physiologists, should move on to study the true situation - messier, more complex, but no less interesting. Testable alternative hypotheses to explain some of the variance in sleep mentation already exist. Of these, we believe that the simplest and most plausible are those that propose a positive relation between memory accessibility and brain "activation" or the within-sleep arousal level.

Rejecting the false REM=dreaming equivalence also can advance research on the purely physiological level. If the wild activity in sensory and motor neurons does not affect mentation, it suggests that this state involves an "internal" deafferentation that prevents these discharges from affecting consciousness (Feinberg and March, 1995). Thus, a remarkable attribute of the REM state, and what may be an essential clue to its function, is the existence of a gross
psychophysiological mismatch rather than congruence. However, to pursue this possibility requires that we accept the falsification of the REM=dreaming isomorphism.

One final imponderable must be acknowledged. The discussion above is based on the assumption that mental activity reported on waking is recall of mentation that was ongoing during sleep. This inference has never been proved, and it remains possible that Goblot (cited originally by Calvin Hall, 1981) was correct 100 years ago: the dreams we report on awakening may be constructed entirely during the waking process itself. While we consider the extreme version of his hypothesis unlikely, we do believe that a considerable portion of the dream report is constructed during and immediately after awakening.

References


Firth,H; Oswald,I (1975): Eye movements and visually active dreams. Psychophysiology 12, 602-606.

Jacobs,L; Feldman,M; Bender,MB (1972): Are the eye movements of dreaming sleep related to the visual images of the dreams? Psychophysiology 9, 393-401.


Feinberg,I; Floyd,TC; March,JD (1987): Effects of sleep loss on delta (0.3-3 Hz) EEG and eye movement density: new observations and hypotheses. Electroenceph. clin. Neurophysiol. 67(3), 217-221.


Foulkes,D; Schmidt,M (1983): Temporal sequence and unit composition in dream reports from different stages of sleep. Sleep 6, 265-280.


Cavalloro,C; Foulkes,D; Hollifield,M; Terry,R (1990): Memory sources of REM and NREM dreams. Sleep 13, 449-455.

Cavalloro,C; Cincogna,P; Natale,V; Occhionero,M; Zito,A (1992): Slow wave sleep dreaming. Sleep 15, 562-566.


Cipolli,C; Fagioli,J; Barontini,P; Fumai,A; Marchio,B; Sancini,M (1988): The thematic continuity of mental experiences in REM and NREM sleep. International Journal of Psychophysiology 6, 307-313.


The SRS Young Investigator Award Committee is currently soliciting applications for the Young Investigator Award for 1997. This award recognizes an outstanding research effort by a new investigator in the field of sleep research. The basis for evaluation of candidates is a single publication in a refereed journal; the candidate should be the first author, and the article must be published or officially accepted for publication by the application deadline. On the application deadline, candidates must be 35 years old or younger or within 5 years of obtaining a terminal degree. Exceptions to the age rule will be considered for those applicants who feel that extenuating circumstances warrant such consideration. A letter detailing these considerations must be included with the application.

The award consists of a plaque and a travel honorarium of $1,000 that may be applied toward travel to the 1997 Annual Meeting. The plaque will be presented at a ceremony at the 1997 Annual Meeting. To apply, candidates must submit 5 copies of the paper, a single CV, documentation of age (a copy of a driver's license, birth certificate or passport) and, if appropriate, a letter outlining extenuating circumstances regarding the age criterion. If a paper is in press at the time of application, a copy of the written notification of the paper's acceptance for publication must also be included. Applicants should provide the name of a senior investigator who will provide a letter of recommendation. The senior investigator doesn't need to be an author on the paper or abstract, but should be familiar with the candidate's role in the research project. The candidate is responsible for ensuring that the letter of recommendation from the senior investigator arrives by the application deadline. Last, a candidate must be a member in good standing of the SRS or must include a completed application for membership and fee with the award application. Repeat applications from unsuccessful applicants from previous years are encouraged.

Candidates are welcome to apply for both the Young Investigator Award and the trainee travel fellowship, but in the event the candidate receives the Young Investigator Award, she/he will receive only this award.

**Application receipt deadline: April 1, 1997**

All applications should be sent to:
Steven J. Henricksen, Ph.D.
Department of Neuropharmacology
The Scripps Research Institute - CVN-13
10550 North Torrey Pines Road
La Jolla, CA 92037

The Sleep Research Society announces the call for nominations for the Senior Investigator Award. This is the Society's highest award for scientific advances in the field of sleep research. The award is given for significant, original and sustained contributions of a basic, clinical or theoretical nature.

Members of the Sleep Research Society are invited to submit nominations to the Selection Committee. A brief letter outlining the scientific contributions made by the nominee and the reasons why the individual should be honored should accompany the nomination. Candidates must be current members of the Sleep Research Society.

Nominations will be reviewed and the Award will be made by a Selection Committee which may also offer nominations of its own. This Committee will consist of the last four Senior Investigator Awardees plus the Past-President of the Sleep Research Society who will also act as Committee Chairperson.

**Application receipt deadline: Friday, April 25, 1997**

Nominations for the 1997 Award should be sent to:
J. Christian Gillin, M.D.
Psychiatry Service (116A)
San Diego VA Medical Center
University of California, San Diego
3350 La Jolla Village Drive, San Diego, CA 92161
SRS Training Program Manual

Dear Training Directors and Students:

Over the last two years the Sleep Research Society has conducted two surveys of undergraduate, graduate, and post graduate opportunities in sleep. The results from these surveys were compiled into the first and second editions of the “Trainee Manual”. In the 2nd edition, 67 programs from Americas, Europe, the Middle East and Asia were represented. This year we will be updating and expanding the manual. With respect to the later, we wish to encourage submissions that identify training opportunities of relevance for MD track students (medical school, resident and/or fellowship opportunities).

Those who wish to submit an entry for the first, PhD or MD track, time are strongly encouraged to do so. Please be aware that the program need not be “an official or an accredited program”. An entry may be submitted by anyone who serves, or wishes to serve, as a mentor or has some academic offering that may be of interest to the trainees (e.g., course offerings, practicums experiences, internships, fellowships, etc.). New and/or revised entries may be submitted via regular post, E-mail, or the Trainee Page on the WWW. Entries are due no later than March 15th, 1997.

REGULAR POST: Michael L. Perlis, Training Opportunities Manual, Department of Psychiatry, University of Rochester, Rochester, NY 14642

EMAIL: dgiles@obgyn.rochester.edu
WEB: HTTP://WWW.WEBSCIENCES.ORG/TRAINEE/

Sincerely,

Michael L. Perlis, PhD  Sean Drummond, BS  Tim Hays, MA
Assistant Director of Training for the SRS  SRS Trainee Representative  Trainee Home Page, Editor
Trainee Program Committee, Chair  T-NET, Editor

MOLECULAR BIOLOGY AND GENETICS
OF SLEEP AND SLEEP DISORDERS

NIH GUIDE, Volume 25, Number 29, August 30, 1996
RFA: HL-96-015
National Heart, Lung, and Blood Institute
National Institute on Mental Health
National Institute on Child Health and Human Development

Letter of Intent Receipt Date: January 6, 1997
Application Receipt Date: March 13, 1997

PURPOSE
The purpose of this initiative is to advance our understanding of the molecular and genetic basis of sleep and sleep disorders. Specifically, the program is designed to stimulate studies on basic molecular correlates of sleep, cellular mechanisms responsible for restorative processes during sleep, the interactions between sleep and circadian systems controlling sleep and wakefulness at a molecular level, the genetic basis of sleep disorders, and the molecular neurobiology of sleep and sleep disorders.

This RFA is a one time solicitation. Future unsolicited competing continuation applications will compete with all investigator initiated applications and be reviewed according to customary peer review procedures.

SPECIAL REQUIREMENTS
The primary focus of proposed studies must be on the molecular or genetic basis of sleep and sleep disorders. Studies of the circadian system must be tightly coupled to mechanisms of sleep control. Psychobiological, neurophysiological, anatomical, or polysomnographic studies which do not include molecular or genetic approaches to understanding sleep will be considered unresponsive to this RFA. Pharmacological studies that
investigate the efficacy of sleep promoting agents but not the underlying molecular mechanisms will also not be acceptable. Studies proposing the use of nonmammalian species should clearly establish the relationship of these models to the goals set forth in this RFA. Applicants are encouraged to contact the program officials listed under INQUIRIES for further information.

INQUIRIES
Inquiries concerning this RFA are encouraged. The opportunity to clarify any issues or questions from potential applicants is welcome.

Direct inquiries regarding programmatic issues to:

James P. Kiley, Ph.D.
National Center on Sleep Disorders Research
National Heart, Lung, Blood Institute
6701 Rockledge Drive, Suite 7024, MSC-7920
Bethesda, MD 20892-7920
Telephone: (301) 435-0199

FAX: (301) 480-3451
Email: Kileyj@nih.gov

Israel I. Lederhendler, Ph.D.
Coordinator for Sleep Research
National Institute of Mental Health
5600 Fishers Lane, Room 11-102
Rockville, MD 20857
Telephone: (301) 443-1576
FAX: (301) 443-4822
Email: ilu@helix.nih.gov

Marian Willinger, Ph.D.
Pregnancy and Perinatology Branch
National Institute of Child Health and Human Development
6100 Executive Boulevard, Room 4B03
Bethesda, MD 20892
Telephone: (301) 496-5575
Email: willingm@hd01.nichd.nih.gov

2nd Congress of the Asian Sleep Research Society
August 24-29, 1997
Jerusalem, Israel
Further Information: Congress Secretariat
Dan Knassim
PO Box 1931
Ramat Gan 52118, Israel

11th Annual APSS Meeting
June 10-15, 1997
San Francisco, CA Membership
Applications for SRS or ASDA Membership
1610 14th St NW, Suite 300
Rochester, MN 55901
507-287-6006

European Sleep Research Society Meeting
Madrid, Spain
September 9-12, 1998

In Memorium

Mr. James Dehler of Rockford, Illinois made a contribution to the SRS in memory of his late wife Kathryn. Several family friends also contributed and their names are:

Barbara LaPier  Patricia Green  Diane Levey
Beverly Franklin  William and Gretchen Steingrandt

Page 15  SRS Bulletin Vol 3, No 1, 1997
Now available on the World Wide Web

NAPS: New Abstracts and Papers in Sleep

- Weekly E-mail Alerts of all new sleep and sleep-related citations
- Personalized for each individual’s specific interests in the sleep field
- Complete abstracts
- Automatically generated forms to request reprints
- Print capability to provide a hard copy of all citations and abstracts
- Archive of the current year’s sleep literature
- Search capabilities customized for the sleep literature

and it’s all FREE

Simply point your browser to the Sleep Home Pages at
http://bisleep.medsch.ucla.edu
or
go directly to NAPS at
http://www.websciences.org/bibliosleep/naps

ANNOUNCEMENT: SRS 1996 ELECTION RESULTS

The following are the results of the election of SRS Officers for this year. All members of the SRS were sent a ballot in November and were asked to return their marked ballots by December 1. Of the 484 ballots sent out to members, 174 were returned (36%). All slated officers were confirmed by a large majority. The results are as follows:

President-Elect:  **Dr. Timothy Roehrs**, Henry Ford Hospital (1997)

Chair for Trainees:  **Dr. Dale M. Edgar**, Stanford University (1997-1999)


An amendment to the SRS Bylaws regarding the number and make-up of members on the Executive Committee reflecting, in part, the recent move to Sections of the SRS also passed with an overwhelming majority: 159 yea; 12 no; 3 no vote.

Congratulations to your new Officers of the Sleep Research Society

Submitted by Steven J. Henriksen, Ph.D. Secretary/Treasurer SRS