

# Lessons From Neuropsychologist John Preston, Psy.D.: On Stress, Sleep, Energy and Solutions that Backfire

BY JOHN PRESTON, PSY.D. [WITH AGNES MURA, M.A.]

*Here is a fictitious scenario which is so typical in today's workplaces that it verges on the archetypal: You are invited to coach a team of three executives, who "can't get along and can't produce the results expected of them"... even though all three have a solid track record of past successes and are viewed as among the most talented people in the firm. The technology project they are working on is of vital importance to the firm: a three year push to reconfigure the fundamental platform for how the company does its business – a highly visible, unprecedented undertaking.*

*At the first team meetings you attend, you observe: Eric seems highly volatile, excited and excitable; Leanne seems to daydream and loses the thread of conversations on occasion, although when she does engage, her input speaks to her vast and well-founded experience; Byrd is often irritable – mostly irritated at Eric, it seems – takes things very personally and withdraws, looking down or away a lot of the time.*

*Dr. Preston's research explains how long-term stress and caffeine or other drugs could be affecting all three executives, causing their reduced mental and emotional capacity.*

## CONTROL OR POWERLESSNESS

In meeting the demands of our environment, however challenging they may be, a key determinant in our capacity to handle them is the evaluation of our own ability to control or master the challenges. Albert Bandura called this type of appraisal "appraisal of one's self efficacy." A person may be burdened with life stressors that can cause a degree of physiological stress response, but what really matters is when a person starts to determine - as a result of an appraisal of their self efficacy - that they can't handle what is before them. It's more than they can take on, or at least it raises the question regarding controllability, and therefore it elicits a feeling (to some degree) of powerlessness or helplessness. This evaluation tips the balance in the direction of the person becoming overwhelmed by the stressors...and it is accompanied by some very significant stress responses on a physiological level.

## SELF-REGULATION

There is a tendency in all human beings to engage in any number of behaviors to reduce either physical or emotional distress in the moment. This self-regulation could be something as minor as shifting your posture in your chair, or other kinds of behaviors that may have a more substantial impact on how one is feeling. Even very subtle amounts of tension or discomfort are often unconsciously responded to so that we will feel better in the moment. One of the unfortunate things that people do is to take actions that are only effective for a short moment: e.g., if you're feeling drowsy and drink some coffee, you rather quickly feel more alert and more energy. People gravitate to reacting in a variety of such ways when they're feeling distressed. This can be an unconscious decision but more often than not, it's not completely unconscious. Frequently, it is a matter of succumbing to a force of habit or something a person does in an automatic way.

One of the great problems with significant stress (either because it stretches a person beyond their comfort zone or because they are perceiving to some degree that they are not in control) is an increased release of the peptide CRF (corticotropin-releasing factor) (also called CRH- corticotropin releasing hormone). It's released from the hypothalamus, and provokes the pituitary gland to release the hormone ACTH, which, once in circulation, eventually reaches the target - the adrenal gland. Here in the adrenal gland, ACTH binds to receptors and causes a release of the stress hormone cortisol.

Cortisol is a very important stress hormone, which accomplishes three things:

1. It helps to increase cardiac output (which other stress hormones contribute to as well).
2. It helps free up extra glucose that is stored in the body (so that a person who is in danger can use it to power their muscles and run or take another form of adaptive action).
3. It activates certain brain structures when it reaches the brain, in particular the hippocampus and the anterior cingulate gyrus, both of which shut off the release of CRF from the hypothalamus, as a way of self regulation. It is a way of reducing affect under normal circumstances. If a person experiences significant stress, either in terms of very strong stressors that are beyond what they are normally accustomed to or stress that is prolonged and significant, then there can be chronic elevations of both CRF and cortisol – a damaging confluence.

### **SLEEP DEPRIVATION**

One of the major problems is that both of these molecules, CRF and cortisol, have a significant impact on sleep. In particular, they reduce the amount of time that people spend in deep sleep. Deep sleep is also referred to as slow-wave sleep or sometimes restorative sleep. When people are deprived of deep sleep, because they are dealing with increased levels of stress hormones in their body, within a few days they often start to feel the effect of not having the right quality of sleep. There are three significant consequences that manifest, when there is a significant reduction in deep sleep:

1. Daytime fatigue;
2. Cognitive impairment (trouble paying close attention, maintaining concentration);
3. An impact on emotions (especially on emotional control) – getting more easily frustrated, more impatient and more sensitive.

A cascade of events will often begin to occur at this point, when self-regulation kicks in: it feels uncomfortable to be tired all the time, and it feels uncomfortable not to be able to be sharp intellectually. So people gravitate towards what provides an immediately answer to these problems. One of the most common ways of self regulating under these circumstances is to increase caffeine use. Caffeine is rapidly absorbed into circulation and within a few minutes, we feel more energy, more alertness, the fatigue is reduced (at least transiently) and we are able to concentrate better.

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If people are feeling somewhat depressed, caffeine may also make their mood improve. Caffeine is a mood-booster; it does tend to have some very transient mood-elevating properties, for 20 minutes or so.

The problem with caffeine however is that if one consumes amounts of caffeine that exceed 250 mg per day (especially amounts exceeding 500 mg. per day), then there is the likelihood that the caffeine is still in the system when going to bed. As a result, the caffeine may begin to interfere with the ability to enter into a deep sleep. The difficulty is not so much with falling asleep (although this can happen if consuming caffeine close to bed time); it is the interference of caffeine with entering into the state of deeper sleep. This further erodes one's well-being in the next day or week, leading to increasing caffeine consumption to combat what is becoming an even greater problem with a vicious spiral of fatigue.

## STRESS AND SLEEP

Stress itself may cause trouble when one wishes to fall asleep. People go to bed feeling tired and they think about the problems of the day, which keeps them awake. Additionally, higher levels of cortisol and other stress hormones, like adrenaline and norepinephrine, that are increased during stressful times, can prevent people from going to sleep. People start turning to common solutions when they feel tired but are not able to sleep. One of these solutions is over-the-counter sleeping pills. Benadryl or products like Tylenol PM (that includes Benadryl and Tylenol) are commonly used. Benadryl does help people go to sleep but it is not very effective for chronic use. Typically, after a week or so, people habituate to it and it is no longer effective. Benadryl can also cause cognitive problems, especially in older persons, as well as weight gain.

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Two even more problematic solutions are prescription sleeping pills and tranquilizers, and/or alcohol. All three of these can, if taken in large enough amounts, put someone to sleep, but the real price paid is that all three of these classes of drugs are notorious for further reducing the amount of time spent in deep sleep. These drugs are seductive in that they appear to be helpful with sleep onset, and they are. Three or four beers or sleeping pills will knock you out, but the main consequence is an erosion of the quality of sleep and amount spent in deep sleep. So there is a snowball effect: increased fatigue, more caffeine, more alcohol, more sleeping pills... until people have unknowingly created their own layer of physiological difficulties in addition to the stress they were experiencing before.

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## DEPRESSION

A great concern has surfaced during the last five years of neuroscience research. People with major depression can experience not only normal elevations of cortisol, but also something called hypercortisolemia, which is a huge increase in the level of circulating cortisol in the blood stream. People experiencing hypercortisolemia are at risk for developing certain kinds of impairment in the nervous system. In particular, cortisol has been found to damage nerve cells in the hippocampus and anterior cingulate gyrus. So toxic levels of cortisol can literally cause brain damage. This kind of brain damage very selectively hits certain brain structures that are involved in two things; one is emotional control, and the other is stress regulation. First, when the hippocampus and the anterior cingulate are damaged, they cannot properly regulate high states of stress nor effectively shut off the stress response. Second, in addition to playing a role in stress regulation, the hippocampus in particular plays a very central role in the ability for new learning. So people can be significantly impaired in that respect if there is damage to the hippocampus.

## NEURO-PROTECTION

In the human nervous system, there is found a particular protein, manufactured in the nerve cells, called Brain-Derived Neurotrophic Factor (BDNF). It is very important for maintaining the health of the brain, because it performs a number of critical functions:

1. It helps to protect the brain from the impact of toxic levels of cortisol. BDNF actually binds to cortisol in the neuron, cuts the molecule and renders it not toxic to the nerve cell.
2. BDNF is important in helping to facilitate ongoing repair of nerve cells over a life-time. Most of the nerve cells of human beings don't replicate (with a few exceptions) and need to last for a long time. BDNF plays a critical role in the mechanisms to facilitate the repair of nerve cells when they are damaged, either by exposure to

trauma, toxins or simply by aging.

3. A discovery five years ago demonstrated that the hippocampus has the capacity for producing new nerve cells. So when there has been damage to the nerve cells, there is the inherent ability to replicate (neuro-genesis). BDNF also plays a role in activating this capacity for neuro-genesis.

The unfortunate thing is that the production of BDNF can be significantly reduced, when people or other mammals are exposed to moderate or severe stressors and are powerless to do anything to reduce the stress or escape. In other words, when mammals perceive that they are to some degree powerless, then the particular gene in the brain that is responsible for coding BDNF is not activated, and the stores of BDNF drop dramatically. So, in a sense, we have a double difficulty: high cortisol levels can themselves be damaging to the brain, and in addition, low levels of BDNF - the natural protective molecule - combine to set the stage for long-term damage to the nervous system.

### **ADAPTIVE STRESS BEHAVIORS**

There are healthier ways or more “adaptive” ways for people to respond under stress, even though they may not be as immediately appealing. At the very top of the list is exercise. Exercise, as everyone knows, has many benefits for general health. But now there are a number of studies that show that exercise itself can be a very potent treatment for anxiety and depressive disorders. In addition, exercise is something that can generate its own form of neuro-protection. Regular exercise, in particular, has been shown to re-activate the production of BDNF, and so it is a very direct way to enhance the ability of the brain to protect itself and actually engage in the repair of the nervous system if it has been damaged from prior depressions or from chronic exposure to stress.

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Additionally, it is very important for people to have a good understanding about how and why caffeine, alcohol and sleeping pills can in fact be “solutions that back-fire.” Dr. Preston uses the following Caffeine Questionnaire to evaluate the state of his patients and students, and help them gauge (and manage) their capacity to learn and self-regulate in productive ways.

A healthy alternative to combating fatigue or low energy levels during the day is to exercise. The good news is that even a ten minute brisk walk has been shown to yield increased and sustained energy for about 90 minutes. This, combined with a gradual reduction in caffeine consumption, will often produce long-term gains. Exercise, in itself, is a healthy thing to do. But one of the most important results of this kind of lifestyle adjustment is the restoration of quality sleep and maintaining a healthy and functional brain. William Shakespeare was right when he said: “Sleep...the bath and balm of hurt minds.”

**Table 1. Caffeine Consumption Questionnaire**

<b>Consumable</b>	<b>Caffeine (mg) per Portion</b>	<b>Average Daily # Portions</b>	<b>Avg. Daily Total</b>
<b><u>Beverages and Candy</u></b>			
Coffee (6 oz, 177 ml)	125	X	=
Decaf coffee (6 oz, 177 ml)	5	X	=
Tea (6 oz, 177 ml)	50	X	=
Green tea (6 oz, 177 ml)	20	X	=
Hot cocoa (6 oz, 177 ml)	15	X	=
Caffeinated soft drink (12 oz, 355 ml)	40-60	X	=
Chocolate candy bar	20	X	=
<b><u>Over-the-counter Meds</u></b>			
Anacin	32	X	=
Appetite-control pills	100-200	X	=
Dristan	16	X	=
Excedrin	65	X	=
Extra Strength Excedrin	100	X	=
Midol	132	X	=
NoDoz	100	X	=
Triaminicin	30	X	=
Vanquish	33	X	=
Vivarin	200	X	=
<b><u>Prescription Meds</u></b>			
Cafergot	100	X	=
Fiorinal	40	X	=
Darvon	32	X	=
<b>TOTAL CAFFEINE INTAKE PER DAY</b>			<b>=</b>
<b>Note: More than 250 mg/day of caffeine <u>may</u> impair deep sleep.</b>			

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**John D. Preston, Psy.D.**

**Phone: 916-558-0282**

**Email: preston.john@comcast.net**

John Preston is a professor of psychology with Alliant International University, Sacramento, California. He has also taught with the University of California at Davis, School of Medicine, and was formerly Dean of The Professional School of