Ray Peat's Newsletter

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Thought and energy, mood and metabolism

"Thought doesn't take any energy, thinking doesn't increase the brain's metabolic rate." For several decades, that was the received opinion of the professionals in psychology and neurology. An experiment was cited. But anyone who knew how to think knew otherwise: Hard thought would increase your temperature, prolonged hard thought would make you hungry, and if you didn't eat, prolonged hard thought could make you sick.

The energetic physiology of nerves and muscles had been studied and it was clear that a stimulated nerve expended energy and consumed energy at a higher rate than a resting nerve. The people who chose to believe the silly doctrine about brain metabolism had to believe that the activity of the nerves in the brain was no more intense during intense thought than at rest. It was something that should have been impossible to believe, sort of like the magic bullet theory of the Warren Commission, in which the bullet that killed the president later injured the governor in several places, leaving several metal fragments in his body, and then was found undamaged on a stretcher. With a strong reason to believe, anything can be believed, and the consequences of holding that belief can be great, seeming to validate the reason for choosing to believe.

Energy, thought, and language flow in one direction, through time, building up persistent structures. The structure of a flame, or of a sentence, is definite, but it takes its form from its situation. The symbolic aspect of language is trivial, subordinate to the energy that supports it.

God guard me from those thoughts men think
In the mind alone.
He that sings a lasting song
Thinks in a marrow-bone.
W. B. Yeats' "Prayer for old age":

In the nineteenth century, Sechenov had explained the brain's activity in terms of nervous reflexes. Vvedensky, Pavlov, and Anokhin had refined the implications of that view. But another school condemned the reflex theory of mental activity as crude materialism, and argued, like Descartes, that the brain's activity was immaterial, spiritual, and symbolic.

John Eccles, who was the most prestigious neurologist in England and America, argued that consciousness was completely immaterial. He took Heisenberg's "uncertainty principle" as a way to argue* that physical laws didn't really control the brain, that the whole system hinged on indeterminacy, and that the randomness of that hypothetical microscopic level provided a foothold for the immaterial soul in the brain. Noam Chomsky went directly from Descartes' view of the immaterial consciousness to human grammar, arguing that it was not necessary to investigate the brain at all, to be able to understand how we can produce and understand language. If a set of rules could "account for" or, in mathematical language, "generate," the grammatical structure of language, the rules would adequately describe the "genetic endowment" (itself a set of rules) that made language possible. The brain itself was to be treated as a "black box," whose function was to be inferred by

**Building any sort of superstructure upon the uncertainty principle is to get something from nothing. The uncertainty principle is a basis for nescience, not for knowledge.*

analysis of language (or, rather, by the devising of a set of rules which are consistent with the ways language is used), without examining the contents of the box.

Every field of cultural activity was affected by these doctrines that feared the identification of the mental and the material. Neokantianism introduced the idea that our perceptions are limited by our genetic endowment, and that as a result of that limitation, what we perceive is in reality only a symbolic abstraction.

In sociology, "symbolic interactionism," and in psychology, anthropology and linguistics various "structuralist" and "functionalist" doctrines offered antimaterialist ways to describe reality. Konrad Lorenz, serving as the theoretician of genocide, applied these ideas to anthropology and biology. Sociobiology and ethology are the current forms of Lorenz's doctrine. While symbolic interactionism has been used to justify cultural relativism, and sociobiology has been used to justify genocide, both of these seemingly opposite schools grew out of similar commitments to an abstracted and symbolic view of reality.

The school of "Artificial Intelligence" derives from, and is committed to, this immaterial, symbolic view of consciousness. The idea of "neural networks" would seem to have incorporated a material foundation, but actually it has only reassimilated the theoretical language that was used by the neurologists of the Eccles school of symbolic, immaterial, neurology. The image of a computer was imposed onto the brain, and then this theoretical description, in which "neural" no longer carried any substantial, metabolic meaning, was able to be used in its denatured form by the immaterialists.

In recent years, new technologies such as NMR/MRI have been able to show many metabolic details of the brain during different kinds of mental activity, and in different sicknesses. 25 years ago, N. P. Bekhtereva demonstrated that specific electrical patterns corresponding to a certain word or image could be identified in the brain, and recently the US CIA has funded research in which brain waves measured on the surface of the scalp can clearly show whether certain words or images have special significance for a person.

When the studies of brain chemistry and electrical activity are combined, it becomes clear that moods and meanings interact with metabolic processes in biologically rational ways, that have to do with adaptation of the organism to its environment. The "content" of our experience, and our substantial metabolism are so closely linked that there is no way to radically distinguish them.

R. D. Laing and Carl Rogers described the process of seeing the world as the client sees it, and they had valuable insights into the meanings of "psychopathology." But they still operated within a "symbolically constructed" reality, ignoring the metabolic, physiological aspects of their clients' problems.

The ability to perceive one's environment and adapt to it depends on having one's metabolic requirements met, and these chemical and physical issues are usually overlooked by psychiatrists, just as the issues of "meaning" may be overlooked by the physiologists.

Responding to particular people and particular demands can create organic and cellular patterns in which the glands, intestines, liver, nerves, and muscles adapt appropriately. The physiological pattern accomodates itself to the demands, but the organism's resources aren't always able to restore the original state, when the demands are no longer being made. Inadequate nutrition and inadequate stimulation limit adaptiveness, and create rigidity of behavior. Learned helplessness describes a global inability to adapt, that's produced by inescapable stress, but something like learned helplessness and unavoidable stress pervades our society, creating pathological rigidities.

The ability to perceive possibilities, and to act on those perceptions, requires biological resources, especially a high level of energy, but there must also be real possibilities in the environment. Several studies over the last forty years have shown that depressed and paranoid people have more accurate perceptions of their situation than happy optimists do.

The interlocking mental rigidities of millions of people are a problematic kind of adaptation. A

slight fluctuation in social relationships, such as losing a job or getting divorced, can cause tremendous changes in both perceived and real possibilities.

Dostoyevsky was interested in the "interlocking mental rigidities," and in various moral or spiritual alternatives. In Russian society, he said, psychopathology was the norm, lies could be therapeutic, and truth was the most poetic thing in the world ["Something about lying," 1873.] He used what might have been called, in the 20th century, themes of ***"anomie,"*** to explore consciousness and values. "Everything is meaningless," or "everything is lawful," instead of leading to suicide or crime, could lead to an exalted view of life's possibilities. Dostoyevski wrote about his own "nervous illness," that included alternating depression and ecstasy, and that has been considered to be some sort of epilepsy or schizophrenia. Whatever his mental illness was, he had a remarkable recovery when he was arrested and sent to prison. Before his arrest, he had been on a vegetarian diet, but in the prison in Siberia he was given a daily portion of hamburger.

Many people have experienced a dramatic improvement of mood when they began eating more protein. On a low protein or starvation diet, the body experiences, in different proportions, the "stress" reaction and the "hibernation" reaction.

An immediate reaction to hunger is to secrete adrenalin, which draws glucose from the liver and fats from the fatty tissues. When the liver's glycogen is depleted, cortisol is produced to mobilize amino acids from muscles and other tissues, to provide energy.

Muscle protein is very rich in tryptophan and cysteine, and these amino acids suppress the thyroid gland's function, and are potentially toxic to nerves, especially in the presence of cortisol and hypoglycemia. Tryptophan is turned into serotonin, which promotes lipid peroxidation, blood clotting, and certain patterns of nerve activity. Serotonin can suppress mitochondrial respiration, and along with the reduced body temperature that it produces, a pattern of torpor or helplessness tends to be produced.

But another pattern can be produced by stress, in which adrenaline and related substances maintain body temperature and alertness, despite the metabolic inefficiency. In hypothyroidism, it is common for adrenaline or noradrenaline to be produced in very large amounts. The brain and pituitary hormones (thyroid stimulating hormone, TSH, and its release hormone, TRH) that tend to increase in hypothyroidism, have their own brain modifying effects, increasing alertness and attention. Hypothyroidism can also cause hypersecretion of ACTH, adrenocorticotropin, which is also a powerful brain stimulant.

These two different reactions to stress, viz., torpor or tension, depression or hyper-alertness, are often seen as reactions to over-sleeping, or under-sleeping. On a Sunday, when a person sleeps an extra hour or two, it's common to feel lethargic for the rest of the day. And when a person has to get up several hours too early, there is often the feeling of being over-stimulated.

Many years ago, someone noticed that depressed people who missed a night's sleep, or who were wakened several hours earlier than normal, came out of their depression, until they caught up on their sleep. Sleep deprivation has become a recognized treatment for depression.

Manic-depressive ("bipolar") people typically seem to need very little sleep during their manic periods.

In depression, there is excessive influence of serotonin, in mania, excessive influence of adrenaline. These chemicals are links between energy metabolism and many specific adaptive physiological processes. One pattern of nerve activity, corresponding to these metabolic patterns, inclines a person to see the impossibility or futility of everything, the other causes an inclination to overlook impediments and undesirable consequences. In either state, important parts of reality are excluded.

Apart from these moods that can be induced by the interactions of diet, hormones, and the demands or opportunities of the envirnoment, the liveliness and vigor of metabolism influence the rhythms of thought and behavior, and the richness of experience and the appropriateness of activities. On a superficial level, our ability to

handle information can be compared to that of a computer, but that metaphor neglects our natural existence, that is like a vortex of biochemical and physical interactions, as well as being an assimilator and projector of impressions, meanings, and intentions. In a computer, the information being processed is separate from the hardware doing the processing, but in us, there is no information, message, content, or memory that is distinct from our living substance. Living substance isn't a collection of distinct objects that can be in this state or that state, because living substance is a process, always renewing itself with more or less appropriateness for its changing situations. Every state of consciousness is a state of being.

Let's look briefly at the way Anglo-American neurology came to look at the brain as a computer. For many years, the dogma said that the brain-computer was "hard wired," meaning that the arrangement of the nerves was genetically determined, set forever during fetal life, and altered only as individual nerve cells died during learning and aging. Since computer wires carried only on/off signals, nerves would carry only on/off signals: When a nerve "fired," it was said to be analogous to an "on-current," and the rest of the time it was "off." The nerve's electrical activity (contrary to clear evidence) was dogmatically identified with the superficial "lipid bilayer membrane," which was said to have only two states, open and closed. This abstract and incorrect description of an individual nerve was originally adopted because many neurologists, in the days before computers, wanted to be able to describe the brain as "a telephone swithchboard," handling messages, however, that were as simple as the patterned clicks of telegraphy. Information was one thing, the switching machinery was another thing.

The school of Pavlov (contrary to Anglo-American dogma) set out to understand consciousness, so when they thought of nerves, they avoided assumptions derived from telegraphy. There has never been any good reason to view nerves as wires carrying only simple "telegraphic" information. P. K. Anokhin, in his last book, discussed the reasons for believing that individual nerves handle complex information complexly. In practical fields, such as the physiology of hearing, there has been recognition that individual nerves seem to transmit qualitative, complex, messages.

The idea of a "hard-wired" computer-like brain was conditioned at every level by the philosophy of the immateriality of consciousness. The idea of telegraphic electrical impulses hardly changed when "neurotransmitter" chemicals were discovered: They just provided links between the filaments that still carried only on/off information. The idea that nerve cell metabolism ***is*** consciousness is still excuded from the ruling doctrine.

Since I have been interested in the way that hypothyroidism, a T3 deficiency, causes sleep problems, I have seen similar patterns in several seemingly different conditions. At menopause, insomnia, hypothyroidism, and diabetes are likely to develop along with hot flushes. Although hypothyroidism often causes the temperature to be subnormal, I saw many women whose temperature before breakfast was normal, but then fell after breakfast, usually following some hot flushes and sweats. Gradually, I began to realize that this corresponded to extremely high adrenalin and cortisol in the morning, and that high morning temperature was sometimes the first sign of the developing "hyper-alert" state, though most often it just represented the stress and exhaustion that result from disturbed, inefficient, sleep.

Using a small dose of T3 normally causes an increase of temperature and pulse rate, but in these people who are in an extremely adrenergic state, the T3 causes both the temperature and heart rate to decrease, as it restores metabolic efficiency. Then, as the stress state disappears, the thyroid supplements will gradually begin to bring the metabolic rate, temperature, and pulse up to normal. When a normal body temperature is maintained by thyroid-supported respiration, rather than by the stress hormones, sleep is efficient.

Thyroid, especially T3, has been commonly used in the treatment of depression, and there are many indications that, as it relieves the depression, it is also correcting a state of stress, lowering the cortisol which is typically

chronically increased in depression, and making sleep restful, rather than debilitating.

Women are especially susceptible to depression, diabetes, hypothyroidism, osteoporosis, Alzheimer's disease, and many other conditions that derive fairly directly from impaired energy metabolism. Some people have proposed that psychiatric problems are equivalent to "neural diabetes." "Syndrome X" (insulin resistance with heart symptoms) represents an advance toward seeing energy metabolism as the central biomedical issue.

Adequate dietary protein, and the ability to use it efficiently, should have the highest priority in the treatment and prevention of nervous and emotional problems, regardless of whether the diagnosis is "bipolar disorder," "depression," "schizophrenia," "multiple sclerosis," "obsessive compulsive disorder," or other official psychiatric category.

Without other nutrients, including sugar, much of the dietary protein is converted to energy, and without good thyroid function, protein can't be used properly. Whey, soy protein, and other industrial by-products sold as protein supplements aren't safe. Eating a variety of animal proteins, with some fruits and potatoes, is the safest way to prevent the metabolic disruptions caused by protein malnutrition.

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swimming test, the (DMI+T3) group showed a significantly decreased immobility time compared with that of the control group. **The noradrenaline (NA) content in the prefrontal cortex was highest in the (DMI+T3) group. Although beta receptor was not altered in any brain region in the (DMI+T3) group, 5HT2A receptor was significantly decreased,** and the dopamine (DA) turnover rate was significantly increased in the prefrontal cortex. This study suggests that the addition of T3 enhanced the action of DMI alone on the monoaminergic system in the prefrontal cortex.

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