The Hypothalamus and the Endocrine System

The Endocrine System, like the Nervous System, is another form of your biological communication system. The Endocrine System consists of a number of glands that produce chemical messengers called hormones that are then sent throughout your body and trigger different physiological (physical) and psychological (mental) reactions.

Hormones are regulated by your brain and are chemically identical to the neurotransmitters you just learned about. Hormones influence internal organs and are involved in the regulation of metabolism, blood sugar level, sexual functioning and other internal body functions that sometimes even affect how you act and behave.

The six major glands responsible for the hormones that affect people the most are:

1. Adrenal Glands
2. Islets of Langerhans (Panchreatic Islets)
3. Gonads (Ovaries in the Female, Testes in the Male)
4. Thyroid Gland
5. Parathyroid Glands
6. Pituitary Gland
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Directions: READ the excerpt from *Psychology* by David G. Myers, and answer the following questions.

1. Define the following terms:
   - hormones
   - adrenal glands
   - pituitary gland

2. Answer the following questions using COMPLETE SENTENCES.
   a. In your own words, describe how an unexpected discovery led to a better understanding of how our body and behaviours are linked. (5 marks for inclusion of details)

   b. Why do you think it takes a long time for somebody to calm down after a stressful event? (3 marks for quality of response)

   c. Using your own words, describe how the Pituitary Gland can affect a person's behaviour. (3 marks for quality of response and inclusion of details)

   d. In your own words, describe how the physical chemical changes in your body can affect your behaviours or personality. (3 marks for quality of thought and effort)

3. Using the diagram found below and the internet, label the proper location of the body's major endocrine glands. You will receive 7 marks for proper labeling.

   Total Marks: ____/ 22
The Hypothalamus

An other of the limbic system's fascinating structures lies just below (hypo) the thalamus, and so is called the hypothalamus. By lesioning or stimulating different areas in the hypothalamus, neuroscientists have isolated groups of neurons within that perform amazingly specific bodily maintenance duties. Some of these neural clusters influence hunger; still others regulate thirst, body temperature, and sexual behaviour.

The story of a remarkable discovery about the hypothalamus illustrates how progress in scientific research often occurs - when curious, open-minded investigators make an unexpected observation. Two young McGill University neuropsychologists, James Olds and Peter Milner, were trying to implant electrodes in the reticular systems of white rats. One day they made a magnificent mistake. In one rat, they incorrectly placed an electrode in what was later discovered to be a region of the hypothalamus. Curiously, the rat kept returning to the place on its tabletop enclosure where it had been stimulated by this misplaced electrode, as if it were seeking more stimulation. Upon discovering their mistake, the alert investigators recognized that they had stumbled upon a brain center that provides a pleasurable reward.

In a meticulous series of experiments, Olds, then went on to locate other "pleasure centers," as he called them. (What the rats actually experience only they know, and they aren't telling.) When Olds allowed rats to trigger their own stimulation in these areas by pressing a pedal, they would sometimes do so at a feverish pace - up to 7000 times per hour - until they dropped from exhaustion. Moreover, they would do anything to get this stimulation, even cross an electrified floor that a starving rat would not cross to reach food.

Similar pleasure centers in or near the hypothalamus were later discovered in many other species, including goldfish, dolphins, and monkeys. In fact, animal research reveals both a general reward system that triggers the release of the neurotransmitter dopamine, and specific centers associated with the pleasures of eating, drinking and sex. Animals, it seems come equipped with built-in reward systems for activities essential to survival.

These dramatic findings made people wonder whether humans, too, might have limbic centers for pleasure. Indeed they do. One neurosurgeon has used electrodes to calm violent patients. Stimulated patients report mild pleasure; unlike rats, they are not driven into a frenzy by it.
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The hypothalamus exerts its control in two ways: electrochemically, by triggering activity in the autonomic nervous system; and chemically, by secreting hormones. **Hormones** are chemical messengers produced in one tissue that travel through the bloodstream and affect other body tissues. Sometimes the affected tissue is the brain: hormones acting on the brain influence our interest in sex, food, aggression, and nurturance (desire to nurture, like a mother to her young baby).

Hormones are secreted by the glands of the endocrine system, the second of the body's communication systems. Unlike the speedy nervous system, which zips messages from eyes to brain to hand in a fraction of a second, endocrine messages use the slow lane. Several seconds or more may elapse before the bloodstream carries a hormone from an endocrine gland to its target tissue. But these endocrine messages are often worth waiting for, because their effects are usually longer-lasting than the effects of a neural message. They are longer lasting because as a chemical messenger, it takes awhile for those hormones to leave your system.

The endocrine system's hormones influence many aspects of our lives, from growth to reproduction, from metabolism to mood, keeping everything in balance while responding to stress, exertion, and internal thoughts. In a moment of danger, for example, the autonomic nervous system will order the **adrenal glands** on top of the kidneys to release epinephrine and norepinephrine (also called adrenaline and noradrenaline). These hormones increase heart rate, blood pressure, and blood sugar, providing us with a surge of energy. Sometimes this is called the "flight or fight" syndrome. The adrenaline is preparing our body to respond to the situation is a physical manner, but it also affects our behaviour. We are more aware, hyper-sensitive to stimuli and often feel "edgy". When the emergency passes, the hormones - and the feelings of excitement - linger awhile.

The most influential gland in our endocrine system is the **pituitary gland**, a pea-sized structure at the base of the brain. One of its hormones has the important task of regulating body growth. Too little of this hormone will produce a midget; too much, a giant. Since 1985, genetic engineering has made possible the commercial production of pituitary growth hormone, making it available to children who suffer pituitary dwarfism. One recent experiment with older adults who had stopped producing growth hormone suggests that injections of this synthetic hormone may have rejuvenating effect, reversing the normal pattern of muscle loss and fat gain.
Besides releasing its own hormones, the secretions of the pituitary influence the role of hormones by other endocrine glands. This makes the pituitary a sort of master gland. Actually, though, its master is the hypothalamus, a key neural system that lies just above it. The hypothalamus, in turn monitors blood chemistry and takes orders from the whole brain. Think about sex (in your brain cortex) can stimulate your hypothalamus to influence your pituitary gland. The pituitary triggers your sex glands to release more sex hormones, which may in turn influence your brain and behaviour.

This feedback system (brain to pituitary to other glands to hormones to brain) illustrates the intimate connection of the nervous and endocrine systems. The nervous system directs endocrine secretions, which affect the nervous system. Conducting and coordinating this electrochemical orchestra is that maestro we call the brain.

Or should we say the mind? Note how fruitless it is to argue whether our brains or our minds are in charge. In the sex example, the mind influences the brain, which influences the body, which influences the mind. Asking whether brain or mind is in control is like asking whether a computer’s output is produced by its hardware or its software. The answer is both, acting together as one whole mind-brain system.