NERVOUS SYSTEM, DRUGS, AND DIET PILLS
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All body functions are under the control of two interactive organ systems: the Nervous System and the Endocrine System. These systems provide rapid and slower paths to effector structures. The Nervous System is concerned with rapid transfer of bioelectric information (impulses), whereas, when the Endocrine System is activated, it secretes chemical messengers (hormones) to target structures. Together, the two systems control all conscious and unconscious responses to changes in the external and internal environments of the body.

The Nervous System is divided into two parts: the Central Nervous System (CNS), consisting of brain and spinal cord, and the Peripheral Nervous System (PNS), consisting of sensory and motor nerve fibers. Sensory nerves respond to internal or external stimuli and send the messages to the CNS, and motor nerves bring the response of the CNS to the affected area to bring about an activity.

How do we perceive and respond to the environment?

Suppose your fingers touch a smooth surface. Certain arrangements of receptor molecules, generally protein in the skin, respond to the contact stimulus. The protein molecules are arranged in a physical structure called a tactile receptor and change their shape when stimulated by the contact. This, in turn, opens up ionic channels in certain nerves and initiates an electrical impulse if the contact stimulus is strong enough (above threshold level). The electrical impulse moves along sensory nerve fibers in a way that is very similar to electrons running along a wire to transfer an electrical signal except that in the case of nerve fibers, it is ions (the charged atoms of sodium, potassium and chloride) that are moving. The impulse is carried to the CNS and in the brain, the message is perceived as a smooth surface that has been touched. If you decide to move your hand away, the message passes to your fingers through motor nerves which cause the appropriate muscles to respond.

Just as tactile receptors are used for the sense of touch, there are numerous other receptors that respond to a variety of stimuli as shown below:

<table>
<thead>
<tr>
<th>RECEP'TORS</th>
<th>STIMULI</th>
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Photoreceptors

Audioreceptors

Thermoreceptors

Olfactory receptors

Gustatory receptors

Neuroreceptors

Hormonal receptors

Light (electromagnetic radiation)

Sound waves

Heat (vibration of particles)

Aroma (airborne chemical stimulus)

Taste (dissolved chemical stimulus)

Sodium ions for salty taste

Hydrogen ions for sour taste

Neurotransmitters

Hormones

In the previous example, it was assumed that only one nerve cell (neuron) carried the message from fingers to brain. In actuality, the round tip pathways concerned with a motor response to the sense of touch involve many neurons in a continual sequence, each nerve cell separated from the next by a very narrow gap known as a synapse. How does the impulse pass across the synaptic gap?

It has been proposed that as the impulse arrives at the synapse from one neuron, a chemical transmitter (neurotransmitter) is released, and these molecules diffuse across the gap until reaching the next nerve cell. Once there, they bind to a neurotransmitter receptor (a protein molecule) just as a key fits into a lock, thereby changing the shape of the receptor protein and promoting continuation of movement of the impulse along the new neuron.

Certain requirements must be for a synapse to pass an impulse from one neuron to the next. First, the impulse arriving at the synapse must be strong enough to release enough neurotransmitters to give rise to the impulse in the second neuron. If this requirement is not met, the impulse cannot pass across the synapse.

Second, since there are many different neurotransmitter molecules, each requires its own specific receptor molecule for the synapse to be effective, just as there is only one key shape to open each lock. Some of the major neurotransmitters are listed below:

<table>
<thead>
<tr>
<th>NEUROTRANSMITTER</th>
<th>EFFECT</th>
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<tbody>
<tr>
<td>Serotonin</td>
<td>Satisfaction</td>
</tr>
</tbody>
</table>
Dopamine → Pleasure
Acetylcholine → Movement and memory
Substance P → Pain
Endorphins → Relief of pain
Norepinephrine (Noradrenalin) → Fight/Flight

Thirdly, once the neurotransmitter has done its job, it must be eliminated from the synapse, otherwise the message is going to go through indefinitely, and we experience the event for too long.

There are a couple of ways that neurotransmitter molecules are removed:

1. Destruction by enzymes
2. Uptake by the transmitting neuron

Different sensations end up in different locations on the brain or cerebral hemispheres. For example, sight is in the rear and hearing is at the sides of cerebral hemispheres.

Drugs and compounds that are generally neuroactive affect the Nervous System by influencing processes occurring at the synapse. They may exert their effects the following ways:
A. A neuroactive compound may be structurally similar to a neurotransmitter that it binds to its receptor molecule, thus preventing the neurotransmitter from binding with its receptor.

B. Drugs may increase the effective concentration of the neurotransmitter, thereby intensifying its effect (called agonists), or they may block the receptor site so that the neurotransmitter cannot bind, so diminishing its effect (called antagonists).

C. Neuroactive compounds may activate or deactivate the enzymes that destroy neurotransmitters, thereby decreasing or increasing their effective concentration.

By these means, it becomes possible to change the perception, sense of time, or even alter the shape of observed images.

**PSYCHOACTIVE COMPOUNDS**

Psychoactive drugs are a group of compounds that affect the Central Nervous System. They may be prescription drugs, over-the-counter drugs, or illicit drugs. They may also be synthetic (man-made) or natural, including herbs and mushrooms.

There are both “pro” and “con” arguments about the use of psychoactive drugs. Some of these claims become irrelevant unless one considers all of the following queries and their many permutations:

1. What purpose does the drug serve?
2. Which drug will be used?
3. How much of the drug will be consumed?
4. Who benefits from use of the drug?
5. Does the drug have unpleasant side effects?

At least six categories of psychoactive drugs exist, each having its benefits and disadvantages when used. When considering use of any of these drugs, one must be clear as to which category it belongs and for what purpose it will be administered.

Other factors to be considered are age, suitability and dosage. Use of certain drugs are suitable for adults but not for infants and children. Similarly, some compounds, when administered in minute doses, are useful medically; when given at higher dosage levels, however, they may be so toxic as to result in death. Many narcotic drugs have specific purposes in medical treatment, e.g., morphine’s administration to combat pain or the limited use of marijuana to assist patients with terminal cancer or cataracts.
Because of a partial or complete deficiency of a certain substance in their system, some people are required to take the appropriate compound to function properly or to stay alive. In the case of endocrine gland deficiencies, it becomes essential that the hormone be introduced externally. The purpose of any drug is extremely important, but its use should not be abused.

There are six classes of psychoactive drugs:

1. Sedative-hypnotic drugs
2. Major tranquilizers or antipsychotics
3. Opiate analgesics
4. Stimulants
5. Antidepressants
6. Psychedelic drugs or hallucinogens

1. **Sedative-hypnotic** or anxiolytic drugs (minor tranquilizers), including alcohol, ether, Valium (Diazepam*), Librium (Librium and Valium are in a category of drugs called benzodiazepins), barbiturates and local anesthetics. Their effect depends on the dosage used. At a very low dose, they cause disinhibition (removal of inhibitory reaction or conscience so that the person will be less inhibited and feel free in what he or she does). A somewhat higher dose can bring about sedation (a calm and relaxed state resulting from moderate depression of the Nervous System). Still, a little more of the drug may cause sleep and still, if more is taken, anesthesia will result. (The distinction between sleep and anesthesia is related to responsiveness or non-responsiveness to painful stimuli). A dosage beyond that producing anesthesia will result in coma and death.

* Most drugs have a generic, as well as, one or more brand names. For example, Diazepam is the generic name of a drug given brand name of Valium.

2. **Major tranquilizers**, antipsychotic drugs, or neuroleptics are drugs used to treat patients with psychosis. There are four classes of major tranquilizers:

   A. Phenothiazines such as Thorazine (chlorpromazine), and Staleazine (trifluperazine).
   B. Butyrophenones such as Haldol (haloperidol).
   C. Thioxanthenes such as Navane (thiothixene).
   D. Atypical antipsychotic drugs such as Risperdal (risperidone).
The psychosis may be mild with only feelings of anxiety or compulsion, or it may be severe enough to cause hallucinations. In any case, these drugs should be taken daily to have a satisfactory effect. In this respect, antipsychotic drugs are unlike most sedative hypnotics, which should be taken only occasionally.

3. **Opiates** or opioids are, as the name implies, extracts or derivatives of opium (poppy). The poppy plant contains hundreds of chemicals and many drugs are extracted from it. Some of these, such as morphine, are considered opiate analgesics, which cause a loss of pain (analgesia) and a feeling of well being (euphoria). Other ones are heroin, Demerol (meperidine), Dolophine (methadone) and codeine. Such drugs are extremely addictive, meaning that after a few times usage, they become “needed” by the user and have to be taken periodically and indefinitely. Without the drug, the addict will suffer from a variety of symptoms including pain, malaise, diarrhea, etc. The withdrawal symptoms can be so severe as to result in death. The opiates also cause tolerance. That means, as the drug continues to be used, more and more is required to yield the same effect.

4. **Stimulants** are drugs that stimulate the Nervous System producing, depending on the dosage, increasing states of hyperactivity associated with nervousness and jittery feelings. This category of drugs includes caffeine, Ritalin (methylphenidate), amphetamines (meth, speed), nicotine and cocaine. These drugs are also addictive and cause tolerance.

Although closely related, a distinction should be considered between addictive and habit-forming. Addiction is a physical need that results in withdrawal symptoms if the drug is not taken at the right time. On the other hand, habit-forming is a kind of desire to use the drug but one can do without it.

5. **Antidepressants** include many drugs, which are used to relieve feelings of depression. There are four classes of antidepressants:
   A. Traditional “tricyclic “ antidepressants, such as imipramine (Tofranil).
   B. Second – generation non - serotonin – specific reuptake inhibitors (non-SSRI), such as bupropin (Wellbutrin) and amoxapine.
   C. Second – generation SSRI antidepressants, such as clomipramine (Anafranil), fluoxetine (Prozac), paroxetine (Paxil), sertaline (Zoloft), and venlafaxine (Effexor).
   D. Monoamine oxidase inhibitors (MAOI) are traditional antidepressants, which have serious side effects, such as fatal interactions with certain foods and medicines. Examples of these drugs are moclobemide (MOC), and tranylcypromine (TCP).

There is an affliction called bipolar disorder (bipolar depression or manic – depressive syndrome) in which the patients are at times highly depressive, and at other times manic.
For this kind of depression drugs such as lithium, carbamazepine (Tegretol), and valporic acid (Depakene) are used.

6. **Hallucinogens**, sometimes referred to as psychedelic drugs, cause hallucinations. Since their effects mimic psychosis, it is said that they produce "model psychosis" state. There are four classes of hallucinogens or psychedelic drugs. First, there are Cannabis products, which include marijuana, hashish, charas, bhang, ganja and sinsemilla. The active ingredient of this class is delta-9-tetrahydrocannabinol (THC). Second, we have scopolamine, which has an anticholinergic effect (block the effect of the neurotransmitter, acetylcholine). Third, we have catecholamine-like psychedelic drugs (the neurotransmitters, norepinephrine and dopamine, are catecholamines). In this class we have mescaline (active ingredient of the cactus, peyote), DOM (STP), TMA, MDA, MDMA (ecstasy), MMDA, DMA, and active ingredients of nutmeg, myristin and elemicin. The fourth class is serotonin-like psychedelic drugs, which are lysergic acid diethylamide (LSD), psilocybin and psilocin (both from the mushroom psilocybe mexicana), dimethyltryptamine (DMT), and bufotenine. LSD is a synthetic product. These drugs do not cause addiction but may be habit-forming in certain people. Through their hallucinogenic effects, these drugs can raise one’s consciousness level and give one introspective and supernatural visions as well as produce abnormal perceptions such as occur in dreams or transcendental states.

Taking any psychedelic drug, without its being authorized or prescribed by someone in the health profession is ill advised. Nevertheless, some individuals abuse these drugs by overdosing on stimulants, such as amphetamines, to induce hallucinogenic effects; other individuals may combine taking a sedative-hypnotic with a stimulant, so-called upper-downers.

**RECEPTOR THEORY**

Receptors are protein molecules with certain three-dimensional shapes. In the Receptor Theory, these protein molecules alter their shape when a molecule having a proper configuration fits into a site on the receptor protein, like a key fitting into a lock. This is the way a neurotransmitter works. It attaches to a receptor and causes a change in the protein's 3-D shape, and this in turn, has certain physiological effects. As an example, when you touch a hot object, your sensory receptor changes conformation (its 3-D structure), thereby causing the firing of sensory nerves.

As one neuron comes into synaptic relationship with another neuron, neurotransmitters are released and diffuse across the synaptic gap. When the neurotransmitter attaches to the receptor
on the second neuron, the receptor molecule changes its conformation, causing the second neuron to “fire”. This sequence is repeated until the message arrives at the brain and is interpreted.

It has been proposed that psychoactive drugs influence mood and perception by attaching to receptors and increasing or diminishing the effect of the neurotransmitter. In other words, stimulants or sedative drugs act to stimulate or sedate neurons through their influence on receptors, either activating or inhibiting the circuitry of the Nervous System. For example, there is a group of chemical molecules in the Nervous System known as endorphins (endogenous or internal morphine). These molecules, although completely different structurally from morphine and heroin, have similar 3-D shapes. The effect of these endorphins is to depress pain and cause a feeling of well being. It seems that when morphine is introduced artificially into the body, the endorphin system is intensified and the feeling of well being is increased. This could explain how addiction arises. By continuous use of opiates, the endorphin-producing system becomes lazy and a dependence on opiates develops.

It may be proposed that in the same way THC (active ingredient in cannabis) has a similar shape to a natural chemical within the Nervous System responsible for arousing transcendental or meditative feelings. In other words, if one meditates long enough, a chemical is created in the body that is similar to THC. Conversely when marijuana is smoked, a yet unknown compound in the Nervous System is activated which creates a perception of having meditated for some time. Indeed such a neurotransmitter called endogenous cannabinoids or endocannabinoids (the only lipid neurotransmitter) and its receptor have been discovered. In the same way, LSD may resemble a natural chemical that is created when an extremely heightened level of consciousness and cosmic consciousness, the level which possibly the prophets reached, is attained.

In no way does the author condone the use of drugs. Heightened states of consciousness can be achieved through meditation, chanting, yoga, etc., without suffering the psychotic side effects that drugs may induce. Attempting to achieve these heightened states by using drugs is like taking a supersonic jet to an unknown destination fraught with unforeseen dangers. It is far safer and more satisfying in the long run to use natural means, such as meditation to achieve states of fuller awareness, as they can then be carefully integrated into the individual’s own psyche.

**DIET PILLS**

One of the major neurotransmitters regulating feelings of satiety and hunger, satisfaction and dissatisfaction, etc., is serotonin. When the level of serotonin in the system is high, a feeling of content is experienced either by the sensation of satisfaction or fullness. Conversely, when the serotonin level is low, the sensation or feeling is one of dissatisfaction or hunger.
Some of the diet pills, such as dexfenfluramine (Redux) and fenfluramine (Pondimin), increase the release of serotonin at certain synapses. This suppresses the appetite, thus reducing the amount of food taken. Stilbutramine or Meridia blocks the reuptake of serotonin and noradrenaline (norepinephrine) in the brain, thereby increasing their effective concentration. Because fenfluramine makes patients drowsy, it is used in combination with phentermine, a compound that speeds up metabolism and acts as a mild stimulant. Together, they do the job without too much stimulation or drowsiness. This combination is the popular diet pill "fenphen". This combination caused certain heart problems and pulmonary (lungs) hypertension (high blood pressure) which resulted in an occurrence of a few deaths and was pulled out of the market.

One of the earliest major groups of diet pills, first used and abused in the 1960's were the amphetamines (Dexedrine or speed). Amphetamines stimulate metabolism so that calories are burned faster. However, because amphetamines fall under the stimulant class of psychoactive drugs and, at high dose levels, act as hallucinogens, they were much abused and acquired a bad reputation as diet pills. Today, a variety of diet pills are available. Besides the serotonin-boosting drugs, there are many others that exert their effect differently. Orlistate or Xenical block digestion or absorption of fat. Leptin is a naturally occurring protein hormone that signals the brain to reduce or stop eating. OB receptors facilitate the action of leptin receptors. BTA-243 starts the process of fat mobilization causing fat cells to release their content of lipids for burning. CCK-Agonist is a hormone-like substance that inhibits eating. NGD-05-1 affects brain receptors or neurons that regulate feeding behavior.

Many of these drugs have not been approved by the FDA and are still in the experimental phase. However, one can anticipate that in the future, increasing numbers of these weight and appetite-controlling pills will become available in the market.