Hampshire School of Hypnotherapy

UNIT 10 READING MATERIAL

Unit 10

Module 1

The Brain/Nervous system vs. the Physical body

A major advance in medical knowledge and practise came from the new philosophy formalised by Rene Descartes in which arbitrary division was made between the physical body and the brain/nervous system. Before going any further, we should satisfy ourselves that this division is justified. We can do this by comparing the cells at each part.

At school, pupils were asked to draw a circular shape with a large black dot in the middle as a representation of a living cell (Figure 1 below). The circular shape was the "cytoplasm" and the black dot was the "nucleus".

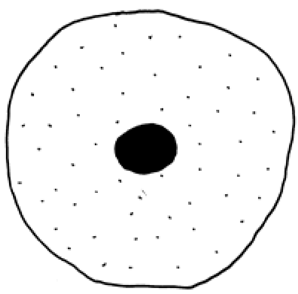


Figure 1

In truth, the cell is far more complicated than that, but in principle, it is a reasonable representation of what cells look like. There are internal variations, depending on the type of cell, but outwardly, they tend to take on the kind of appearance. Some may appear round, some square, again depending on cell type.

1. As can be clearly seen in Figure 2 below, it looks completely different from the cells of the physical body. All the cells of the brain and nervous system look like this. So the first way in which this division is justified is because the cells are STRUCTUALLY DIFFERENT.

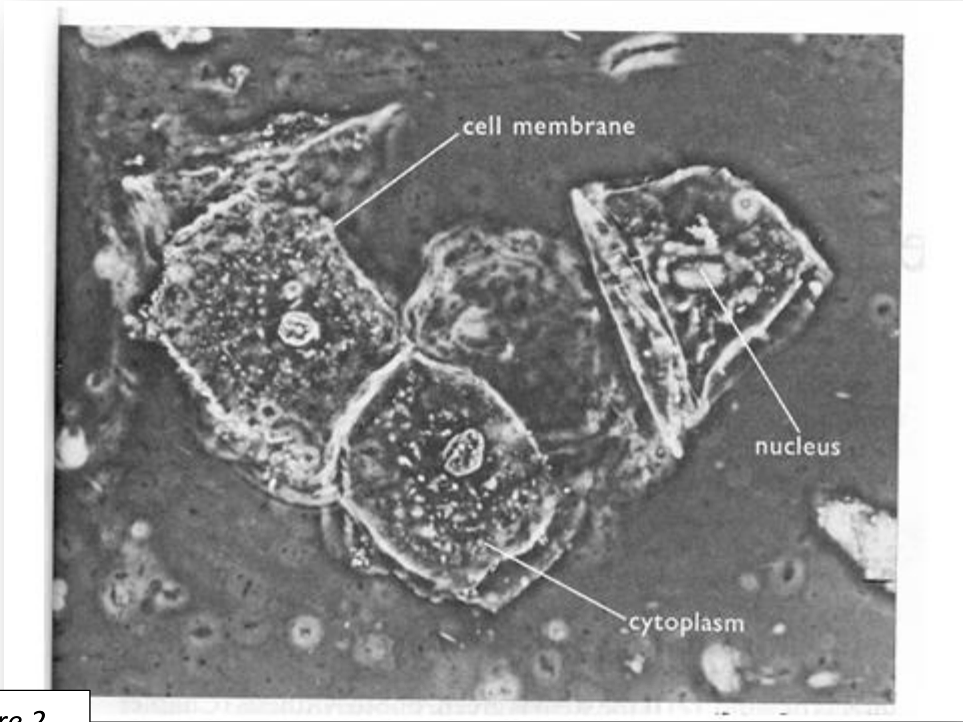


Figure 2

2. Another way to justify this division is to look at function. The cells of the physical body tend to be closed units in that they do not interact with other cells. On the other hand, the prime function of a neuron is to activate other cells. So the second justification is that nerve cells are FUNCTIONALLY DIFFERENT.

3. The third justification concerns regeneration. You may have heard it said that over a period of time, every cell in your body is replaced. This is true as regards the cells of the physical body. The cycle of replacement varies according to the type of cell concerned. Skin cells are continually being worn away and so have a short cycle. Bone cells are deeply embedded and stronger, so the replacement cycle is much longer. In contrast, the neuron has always been generally considered by science to be the only cell in our body that, under normal circumstances, does not regenerate. We spend our early years, up to mid to late teens, making neurons and building our brain and nervous systems. The cells made during this time are the only neurons we will ever have. If any of them die or are damaged, they are not replaced. The third justification must therefore be that neurons are REGENERATIVELY DIFFERENT.

We now have three reasons for saying that the physical body should be considered as separate from the brain and nervous system. These three reasons all concern the basic building blocks-the cells.

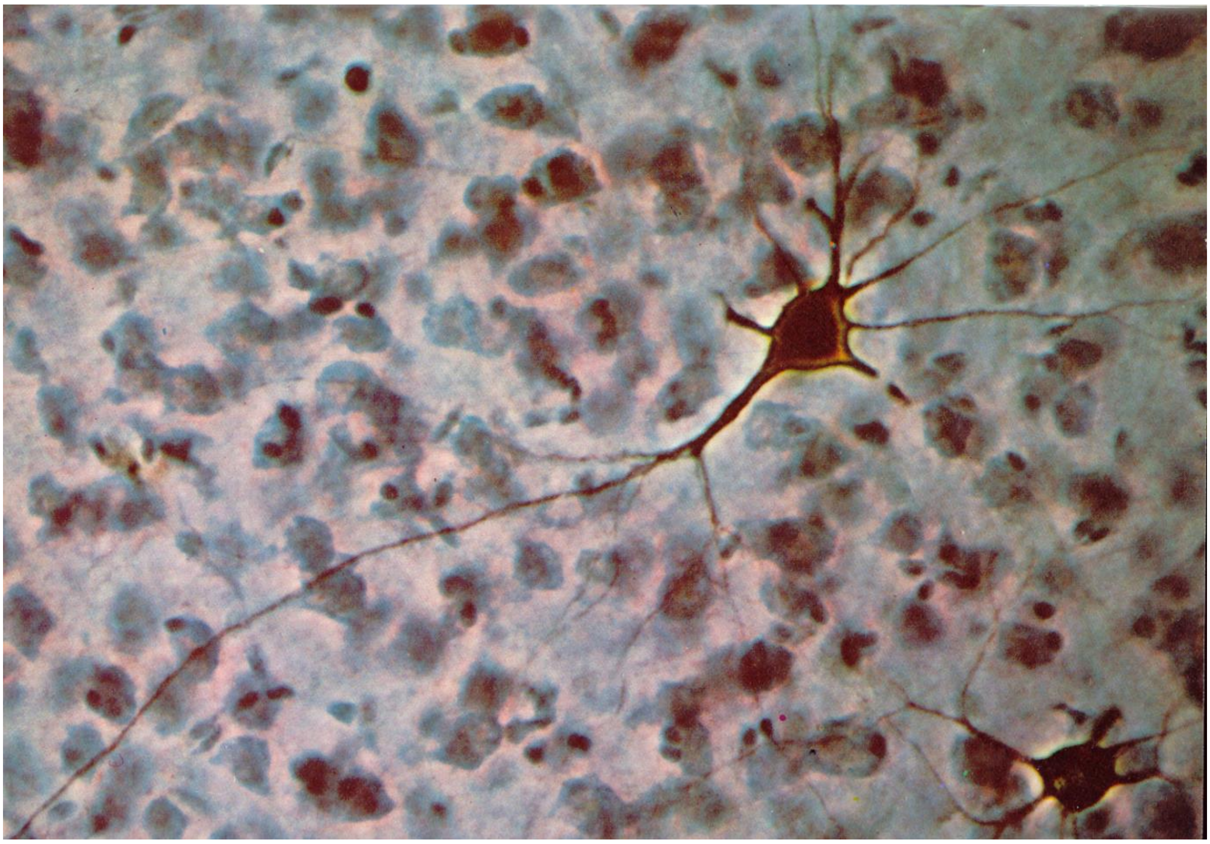
One question to ask if that if, “under normal circumstances”, neurons are not replaced, what would happen if the circumstances could be changed? Could neurons be made to regenerate? Scientific research indicates that this does not normally happen but there is a growing acceptance that, under certain conditions, it can occur.

Module 2

Neurons

Having established that it is reasonable to view the brain and nervous system as a separate system, let us now have a look at what is known about it.

The basic building block of the entire nervous system is the neuron.



The illustration below (figure 1) of the neuron is a stylised diagram showing the basic structure of all neurons.

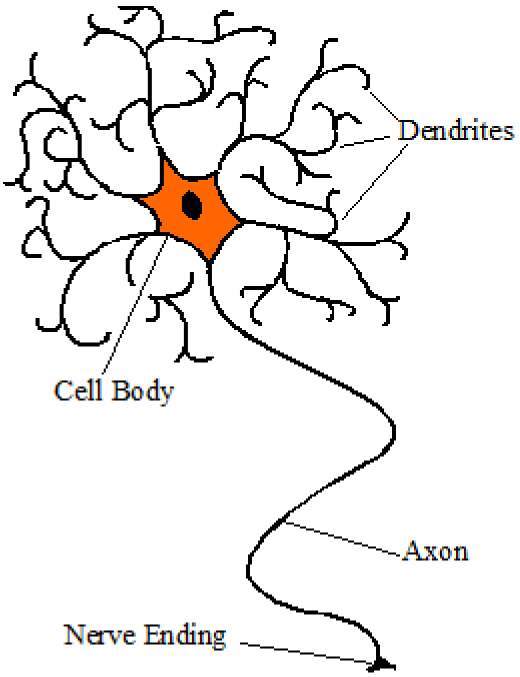


Figure 1

The dendrites are the sensors of the neuron. Their job is to pick up impulses from a specific source. That source may be another neuron or a particular type of body sensor. The impulse is then passed on to the cell body. This is the part of the neuron that most closely resembles the cells of the physical body in that it houses the nucleus of the cell and is surrounded by cytoplasm.

From the cell body, the impulses then travel down the length of the axon until it reaches the nerve ending. There are different types of nerve endings, depending on the job involved. If the neuron is one link in a chain of neurons, having a job passing on an impulse from one neuron to another, then the nerve ending will be a “terminal button”. If its job is to make a muscle contract, the nerve ending will be a “muscle end plate” and so on.

While it is true to say that all neurons have this structure, there is variation, mainly concerned with the length of the axon. If the job of the neuron is simply to make a connection between two closely situated neurons in the brain, the size of the entire neuron is microscopically small. At the other extreme, the longest neuron you have in your body is between two and three feet in length, which, for one cell, is gigantic. The variation is only in the length of the axon: the other parts do not vary accordingly.

Module 3

The Myelin Sheath

When considering long axons, it is worth considering the speed of impulses. In some circumstances, the normal speed of an impulse would not be fast enough. For instance, if you put your hand on a hotplate, you would need to get it off quickly to avoid serious damage. We should also consider the fragility of the axon. Such a slender fibre could be very easily damaged.

To overcome both problems, the long axons of certain neurons are covered by a material called myelin. This sheath of myelin is not like a continuous tube. It is in sections. The very presence of this myelin sheath reinforces and strengthens axons, giving it considerable protection. It also accelerates the impulses. See Figure 1 below.

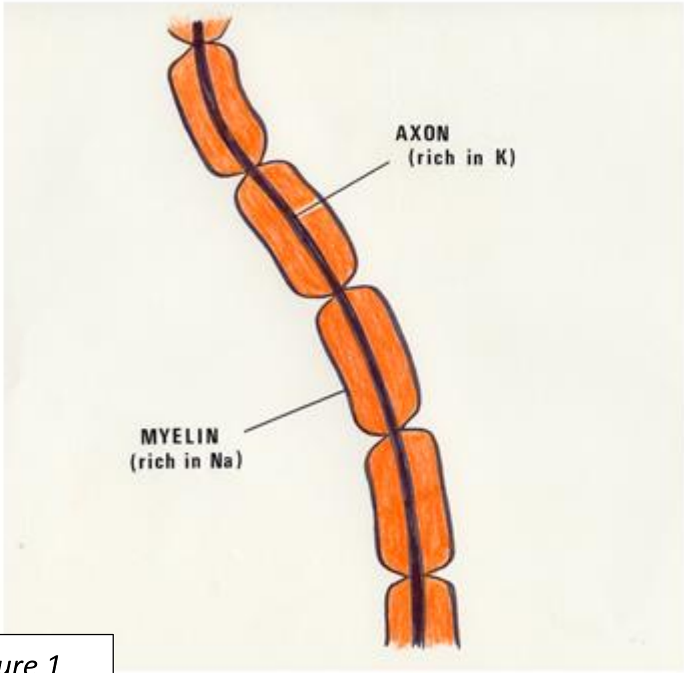


Figure 1

Module 4

Impulse Transmission

Contrary to many peoples' belief, nerve impulses are not purely electrical. If they were, we would interact with every piece of electrical equipment we came near. They are electro-chemical but the electro-component is very small and identical to the operation of the neuron. It is therefore easier to think of nerve impulses as being chemical reactions.

The axon itself is rich in potassium whiles the myelin is rich in sodium. During the transmission of an impulse, these two chemicals interact.

The presence of the impulse puts pressure on the potassium in the axon, forcing it out into the myelin. This causes the sodium in the myelin to move into the axon. So the two chemicals have changed places. The reaction continues in a circular fashion until they have returned to their original positions. The pressure is now on the next node in the chain and the reaction is repeated. And so it goes on, node after node, throughout the entire length of axon, until the impulses reach the nerve ending. See figure 1 below.

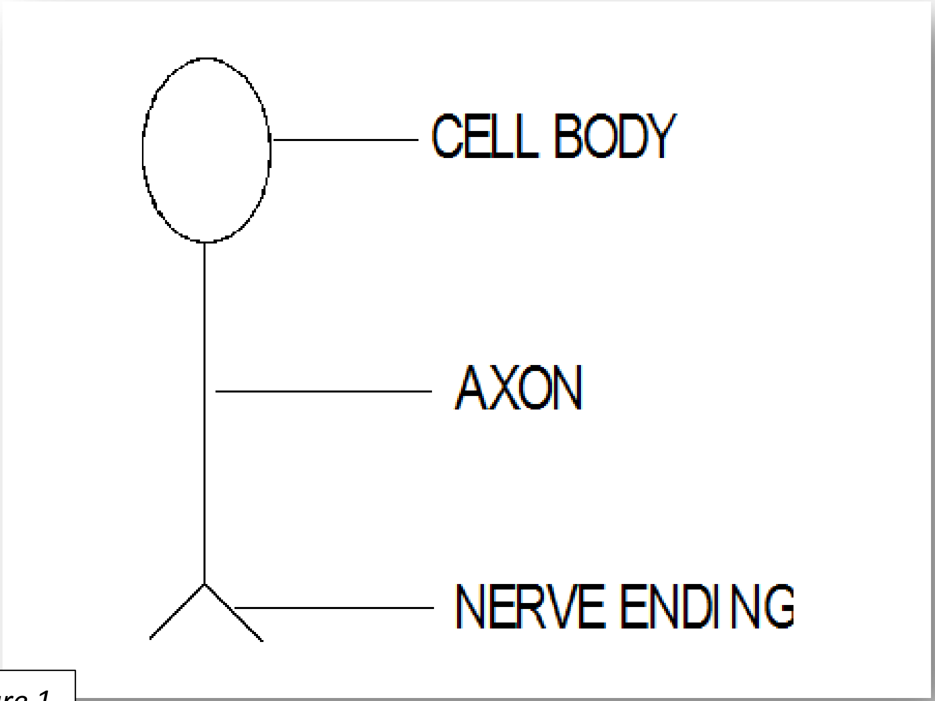


Figure 1

As you can see from this, the route of the reaction is not direct, and it is not always easy to visualise that this method could be faster than the direct route taken by unprotected neurons. An analogy that may help here is a bucket chain. It is quicker and less tiring for a number or people to pass buckets of water from hand to hand over a distance than for one person to make repeated journeys.

Module 5

Multiple Sclerosis

Let us now make a small digression to consider the condition known as multiple sclerosis (or MS). This is a condition involving a gradual deterioration of neuronal functioning. Symptoms can include disorientation, lack of muscular co-ordination and jerkiness in movement. Structurally, what has happened here is that a chemical has got into the cerebrospinal fluid (CSE – the fluid in which the brain and spinal cord are suspended) and attacked the myelin sheath. With the myelin destroyed, the axon has now lost its protection and its means of accelerating impulses. It is rather like sparking across a gap, leading to jerkiness and co-ordination difficulties.

Science says that under normal circumstances, neurons cannot regenerate. Any damage is therefore permanent. MS is therefore considered to be incurable. The best we can hope for is to halt the damage and stop it progressing further. The nature of the condition is such that the deterioration often happens in fits and starts.

In other words, there are periods when the deterioration stops. This is called a "remission period". Because of this, sufferers are considered to be on a downward slide, with no hope of a cure. So adamant is science about this, and so strong is its influence, that anyone claiming a cure for MS (even if one actually exists) would face legal proceedings forcing them to substantiate their claim, in a very concrete way, in the face of fierce opposition.

However, rather than dismissing this as a hopeless case, let us consider some of the things we have discussed previously. The first job we assigned to the subconscious mind was to maintain and operate the physical body. As we will see later, this works down to microscopic level. The subconscious is involved in chemical balance, regeneration of cells and a whole host of other things. In your formative years, your subconscious was busy building your brain and nervous system. There had to be a plan to work to and materials to work with. Every single neuron was built according to this plan – INCLUDING THE MYELIN. The subconscious therefore knows how to do it. It knows how to make myelin. It knows how to wrap it round an axon. In other words, there must be a way.

Historically, hypnotherapists have been helping MS patients for years, with remarkable success. Patients who originally had to be carried into the consulting room for treatment are now walking about quite normally. However, legally, we cannot say they are cured. They have gone into a remission. The fact that this remission may be permanent, and that all the symptoms have disappeared is incidental. How has this been done? Simple: by influencing the subconscious mind that built the system in the first place.

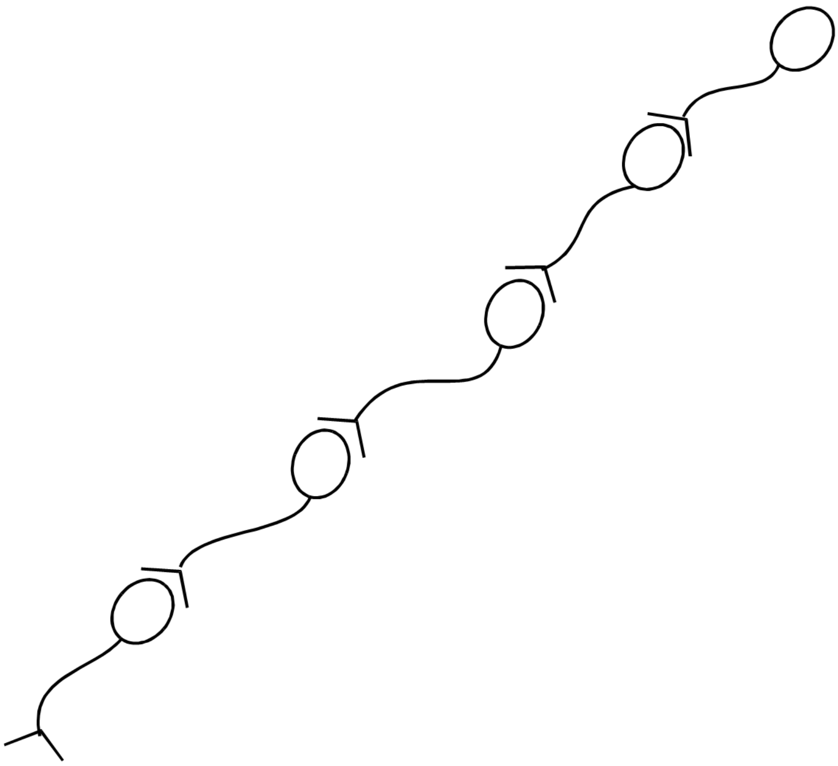
Unit 10

Module 6

Symbology

Obviously, there are people involved in neurobiological research who are concerned with mapping out the neural circuitry of the brain. It is useful for them to use symbols when committing this to paper.

Circuits are built up this way. To be very simplistic about it, the statement is that it takes more than one neuron to send a message to move your big toes. The first neuron may go to the base of the skull, the next one stretches down to the base of the spine, then to the knee; then the ankle, the base of the toe and so on. All of the neurons are situated nose to tail.



From our point of view, the interesting thing about this diagram is the junction between any two neurons (known as the synapse). They are not shown as being in physical contact with each other. This is no accident. It reflects reality. Neurons do not physically touch each other. There is always small gap between them. This gap is called the synaptic cleft, and we shall look at this next.

But first, we need to take a little diversion in order to understand an important principle involving the structure of molecules.

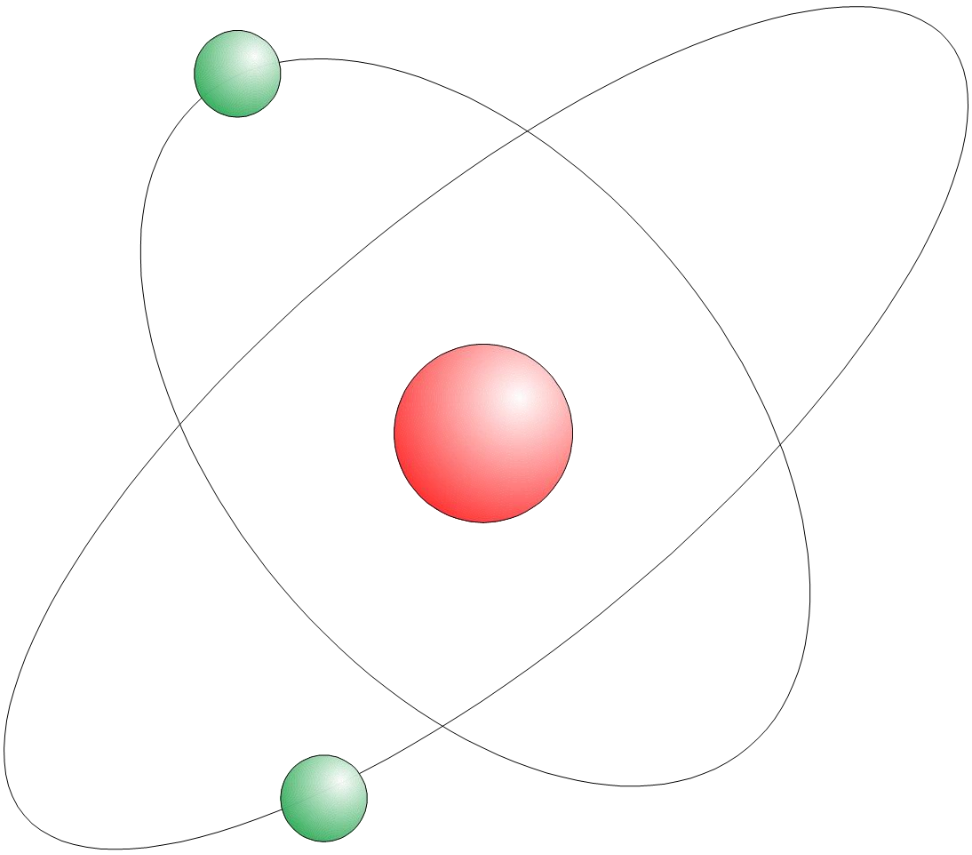
Unit 10

Module 7

Atoms and Molecules

In our school days, we were taught that all matter is made up of atoms. You may have been taught that atoms are like miniature solar systems – electrons orbiting around a nucleus. This may be a true representation of their structure, but it is not very convenient to visualise it this way when considering how they join u to make molecules. An easier way is to think of it as being like a ball with a number of arms projecting out from it.

The atoms of a particular element all have the same number of arms. For instance, hydrogen atoms all have one arm only (shown in red), while oxygen atoms have two (shown in green). When free atoms come close enough, they link arms to form a molecule. When no free arms are left, the molecule is complete.



This shows two hydrogen atoms linking their single arms with the two arms of an oxygen atom. Since there are now no arms free, the molecule is complete, and we have a molecule of hydrogen hydroxide – H2O – water.

If we now complicate this a little, and consider six atoms. Two have three arms, two have two and two have one each. (The number of “arms” an atom has is called its “valency”).

When these six atoms come together to form a molecule, there is more than one way in which they can do it.

They could have come together to form a molecule that is rectangular. They might also come together to form a different shape. Chemically, both molecules have the same formula, but they are not the same. These two molecules would have different properties and behave in different ways. THE SHAPE OF A MOLECULE IS AS IMPORTANT AS ITS COMPOSITION.

This is the principle we need to bear in mind in our consideration of the synapse, since the shape of the molecules is of prime importance to the discussion.

Module 8

The Synaptic Cleft

The synaptic cleft is the gap that exists between the nerve ending at the end of an axon and the surface of a dendrite belonging to the next neuron in the chain.

The nerve ending is bulbous in appearance. A cross-section of this would reveal that it contains a number of cavities. These are called "vesicles" and are miniature chemical factories in which substances known as neurotransmitters are made. When an impulse arrives at the nerve ending, this chemical is released into the synaptic cleft. It then settles onto the surface of the dendrite and activates it, setting up the impulse to be transmitted through the new neuron.

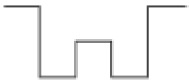
To help us understand this in more depth, let us now consider an imaginary situation. Imagine for a moment that we have two chains of neurons running parallel. One concerns the movement of the big toe. The other moves the thumb of one hand. Let us now suppose that you want to move your toe. An impulse travels down the neuron to the synapse. The neurotransmitter is released, but some of it drifts out of the cleft and into a cleft in the parallel chain, and settles on the dendrite of the neuron controlling your thumb. According to our understanding so far, the thumb should move. But is doesn't. Why?

The answer is that the nervous system uses not just one neurotransmitter but many. Each of these chemicals is peculiar to specific circuits and is used for a specific job. Adrenaline for instance is a neurotransmitter, so is noradrenaline, acetyl choline and a number of others. The molecules of each of these neurotransmitters has a very specific shape, and it is the shape of the molecules that prevents your thumb moving when you want to move your big toe.

Let us now look at this in more detail.

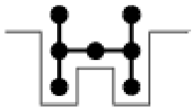
The Lock and Key Mechanism

Just as a key has to be the right shape to fit a lock, so a molecule has to be the right shape to fit a receptor, if it is to work.

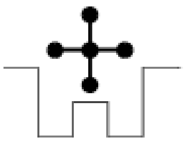


If the shape of the receptor is like that shown on the left, the molecule must have a shape like that shown on the right. If this is not so, the neuron will not fire. This describes the normal operation of neurotransmitters.

There are a number of different neurotransmitters. The molecules of one are a different shape to those of another. This ensures that inappropriate firings do not take place. This has a bearing on the variations shown below.



The Wrong Key

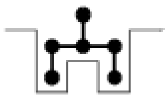


If a molecule of the wrong shape settles on a receptor, it prevents the neuron from firing. It also prevents the right molecule from settling. Thus, the neuron cannot fire while the receptor is occupied by the wrong molecule.

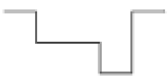
This describes the method of operation of drugs known as depressants, or blockers. They are designed to prevent the neurons from firing. Thus, they are used to suppress hyper-activity, etc.

Similarly, if enough of a molecule is of a shape that will fit a receptor fully, then it will fire the neuron even though it is the wrong molecule. (As shown on the right.)

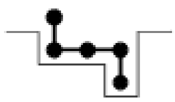
This shows how drugs known as stimulants work. These are chemicals which mimic natural neurotransmitters by making neurons fire when there is an absence or deficiency of the appropriate neurotransmitter.



The Wrong Lock



The discovery of a new receptor puzzled scientists for a long time. The puzzle was that the receptor was of the wrong shape to accept any of the known neurotransmitters. It required a very specifically shaped molecule.



The puzzle was intensified when it was found that the molecules of certain opiate drugs were of the right shape to fit this receptor. Surely man is not designed to be an opium addict!

The answer came in the late seventies when it was discovered that under certain conditions a chemical known as beta-Lipotropin, which occurs naturally in the human body, breaks down to release molecules of exactly the right shape to fit these receptors. We now know these as ENDORPHINS.

Above is an assumed representation of a molecule (neurotransmitter) released from an activated nerve ending (i.e. an impulse has arrived). The shape next to it represents a receptor site (of which there are many) located on the surface of a dendrite belonging to the next neuron in the chain.

Notice the shape of the indentation (receptor) in the surface of the dendrite and the shape of the molecule. It is easy to see that the molecule will fit exactly into the receptor, as shown.

This is known as the “lock and key” mechanism. Just as a key has to be the right shape for a lock to be operated successfully, so a molecule has to be the right shape for a receptor to set up an impulse in a neuron.

Now consider what happens if a different molecule wanders into the cleft (Handout.) When this molecule tries to settle into the receptor, it will not fit exactly. Consequently, the neuron cannot fire because the receptor has been blocked.

While answering our original question, the situation shown in the handout has a much deeper application, which introduces discussion on drug use. While that inappropriate molecule occupies the receptor site, a molecule of the right type cannot get in either. The receptor is blocked, and will not be able to fire until the offending molecule clears the site. This is what psychoactive drugs known a “blockers” and “depressants” do. They are designed to get into the synaptic cleft and occupy the receptor sites, thus preventing neurons from firing. The overall effect is a quietening down of the nervous system. Consequently, these drugs are prescribed for patients suffering with tension, hyperactivity and so on.

While on this subject, let us consider another situation.

An alternative molecule (mimicking molecule) is different in shape from that shown in the earlier one (lock & key) and so is not a molecule of the correct neurotransmitter. However, when this one tries to settle, it fits and so an impulse will be set up and the neuron will fire. This is an example of a molecule that mimics the action of a neurotransmitter. We are now looking at the action of psychoactive drugs known as “stimulants”. Their purpose is to make neurons fire when they otherwise wouldn’t. These are prescribed for patients suffering with depression, apathy, etc

Before leaving the synapse, there is one more important thing to discuss.

Here we have the surface of a dendrite showing three receptor sites. Two of them are occupied by molecules of the neurotransmitter. The third receptor is a different shape, and would not accept another molecule of the same shape as the others. For this receptor to work, we would need a molecule shaped like that shown in the diagram, 'the required molecule'.

So what is it?

The answer to this question baffled science for many years. It was known that these receptors existed but nowhere could they find a naturally occurring molecule that would fit it. The problem was aggravated when it was discovered that the molecule of a drug derived from opium was exactly the right shape to fit this receptor. Surely we were not designed to be opium addicts the search was on.

The answer began to emerge in the late seventies when a laboratory technician was carrying out a spectrographic analysis of a particular protein called beta-Lipotropin. This is a naturally occurring protein found in the human body.

Protein molecules are large molecules formed when other molecules called amino acids join together in a chain. The sequence in which the amino acids occur in the chain, determines the type of protein that results.

This laboratory technician was involved in determining the sequence of the amino acids in beta-Lipotropin when he noticed something strange. Every now and then the same sequence of five amino acids kept recurring in the chain. Each time he checked, the same thing occurred.

He decided to write a paper about this, and other researchers began to look at this closely. They found that under certain circumstances, e.g. stress, pain etc., the beta-Lipotropin in the body breaks down. When it does, it releases these chains of five amino acids which then reform themselves into a new molecule which is exactly the right shape to fit the mysterious receptors that had baffled scientists for so long.

It helps to understand their purpose if we look at the effects of the opiate drug that mimics it. Opiate drugs tend to be administered medically for pain relief. Socially (or anti-socially) they are used for the feelings of euphoria they produce. These two effects were found to be the main effects of these newly-discovered molecules.

Being a new discovery, they had to be given a name. The name chosen was "endorphins" (sometimes called "enkephalins") and much more has been found out about them since.

For instance, during pregnancy, the mother-to-be manufactures beta-Lipotropin in large quantities. At the time of birth, this breaks down to release a vast amount of endorphins into the system, which helps to relieve much of the pain which would otherwise be unbearable.

The subject of childbirth is very appropriate in the consideration of another important principle. The endorphin system is like any other system in the body in that balance is important. If that balance is upset, the system does not function properly.

One way to upset the balance is to introduce stress into the situation. If a pregnant woman is indoctrinated in the line of thought that says "its agony, it's terrible", then the fears this produces as the time gets near, interfere with the endorphin system. Smaller quantities are produced, and the whole experience lives up to her expectations of pain and discomfort. If on the other hand, she goes into it with the attitude that "this is a natural function, it will be easy", then she allows the system to work at its best and will have a comparatively easy time of it. It is interesting that there is more interest in "natural childbirth" these days. It represents a social manipulation of the endorphin system.

Another area where endorphins play a part is in athletic pursuits. Many athletes talk about the pain barrier and the euphoria that follows. They use phrases like "no pain, no gain". They are in fact driving their bodies to the point where they break down beta-Lipotropin to release endorphins. These relieve the pain and produce the high.

One final example. A schizophrenic patient who suffered auditory hallucinations was given a lumbar puncture. The cerebra-spinal fluid was found to be awash with endorphins. When he was injected with the endorphin antidote, the hallucinations stopped immediately. In other words, over production of endorphins is as dangerous as under-production is uncomfortable. THE BALANCE IS IMPORTANT.

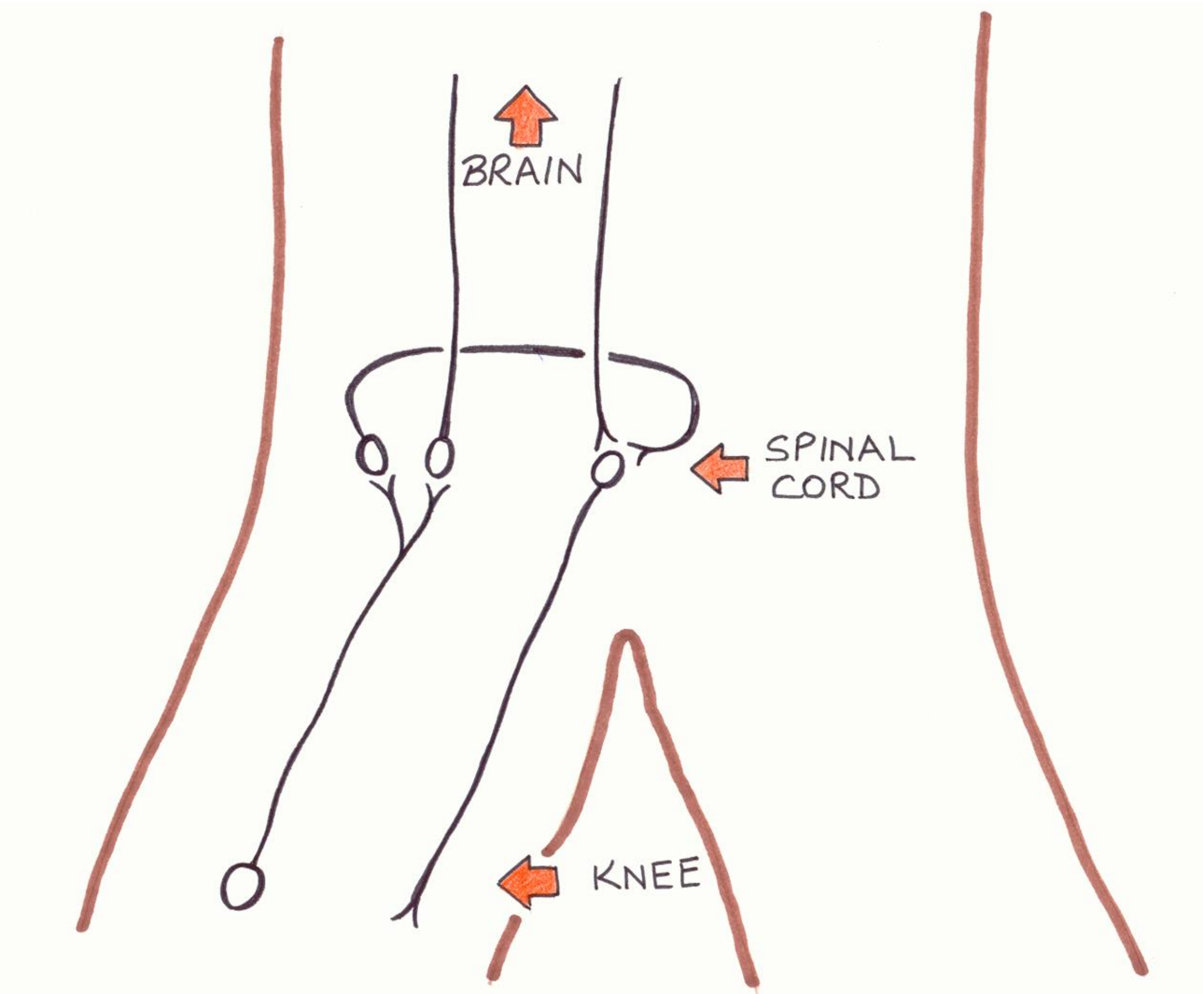
WARNING - DO NOT assume from this that schizophrenia can be defined simply as an endorphin imbalance.   It is far more complicated than that.

Module 9

Reflexes

It is widely thought that all the work of the nervous system is done in the brain and that the neurons going to and from the brain are merely pipelines connecting it to the various parts of the body. This is not the case. A great deal of work is also done in the spinal cord.

A simple example that illustrates this point is the knee jerk. You may have experienced this yourself during a medical examination. You are asked to sit with your legs crossed. The doctor then taps your knee with a rubber hammer provoking a lower leg jerk.



When the knee is struck, an impulse travels up the thigh to the base of the spine. A bridge is located here in the form of a neuron which connects to another neuron going back down the thigh to make the knee jerk. In other words, the impulse goes up to the base of the spine and back again, without involving the brain at all.

True, there is a neuron going from the base of the spine to the brain. This is to let the brain know what happened. There is also a neuron coming down from the brain. This is for the impulses involved in the normal voluntary movement of the leg. But in the context if the reflex action, the brain need not be involved at all.

Mechanisms like this one save time. There's no need to wait for an impulse to travel all the way to the brain and back again before a reaction can occur. This is a valuable asset, particularly when danger threatens. If you put your hand on a hotplate you need to remove it as soon as possible. Reflexes like this allow us to do so.

Module 10

The Autonomic Nervous System

Similar circuits are also found in a very special part of the anatomy called the autonomic nervous system (A.N.S.) which calls for special consideration. The A.N.S. is mostly housed in the spinal cord, although some of it is in the brain. Because of this, it works at a very fast rate.

There are two parts to the A.N.S.: the sympathetic nervous system and the parasympathetic nervous system. One of the main functions of the sympathetic nervous system is to prepare the body for immediate action in a time of emergency.

Imagine someone crossing a road without paying proper attention. Suddenly they hear a hooter and become aware that they are in the path of a fast-approaching vehicle. The immediate concern is to get out of the way.

In a split second, several changes occur in that person's body. First, large amounts of adrenaline are pumped out into the bloodstream to provide the vital energy for the muscles. The heart rate increases to speed up the distribution. The respiration rate increases to bring in more oxygen. The pupils of the eyes dilate to sharpen the vision. Gooseflesh appears, and cold sweats. If you have ever been in a situation like this, you will also have noticed the tingle that runs up your back.

All of these things are the work of the sympathetic nervous system. It brings the body into an immediate state of arousal to facilitate immediate action. This is often referred to as preparing the body for "fight or flight" in a case of emergency. Because of the need for speed in a situation like this, there is no time to involve the brain.
Consequently, most of the work is done in the spinal cord. The brain is informed later.

Once the danger is past, the changes brought about by the sympathetic system are no longer required and need to be undone. This is the work of the parasympathetic nervous system – to restore normality.

These two systems are often thought of as working like a seesaw. When the sympathetic is activated, the parasympathetic is deactivated and vice-versa. For the most part, this is a true statement but there are a few situations when both or neither is activated.

Module 11

The Need for Balance

It is not difficult to see that again this is a system where balance is important. In a state of normality, the seesaw should be level. Unfortunately, there are occasions when that balance can be upset.

Let us suppose for a moment that after a dangerous episode is over, normality is not quite restored. The sympathetic system is slightly ticking over. We have a situation here where adrenaline is trickling out into the system. The heart rate is just a little faster than it should be. The respiration rate is just a little faster than it should be; the person is in a state of arousal when there is no need. Thus, the person is fidgety, anxious, tense, and perhaps hyperactive.

Conversely, what happens if the parasympathetic system is overpowering the sympathetic system? The person displays symptoms of apathy, lethargy, and often depression.

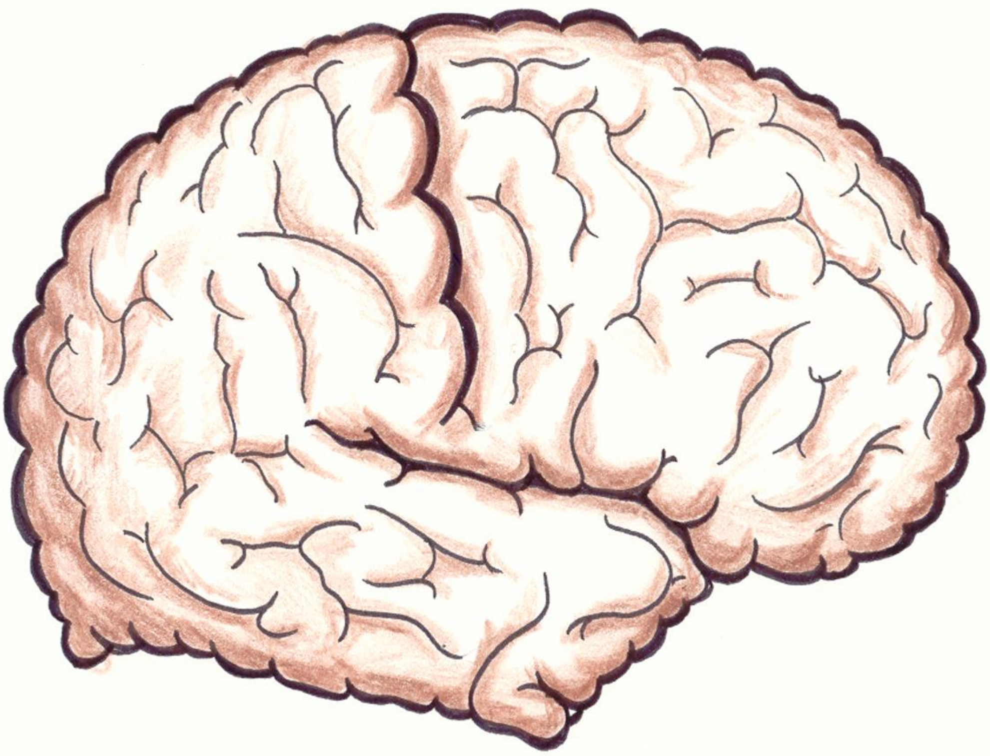
Consequently, any successful treatment given to people displaying such symptoms will have the effect of restoring balance in the A.N.S. Hypnotherapy has proved to be particularly successful in this area.

Unit 10

Module 12

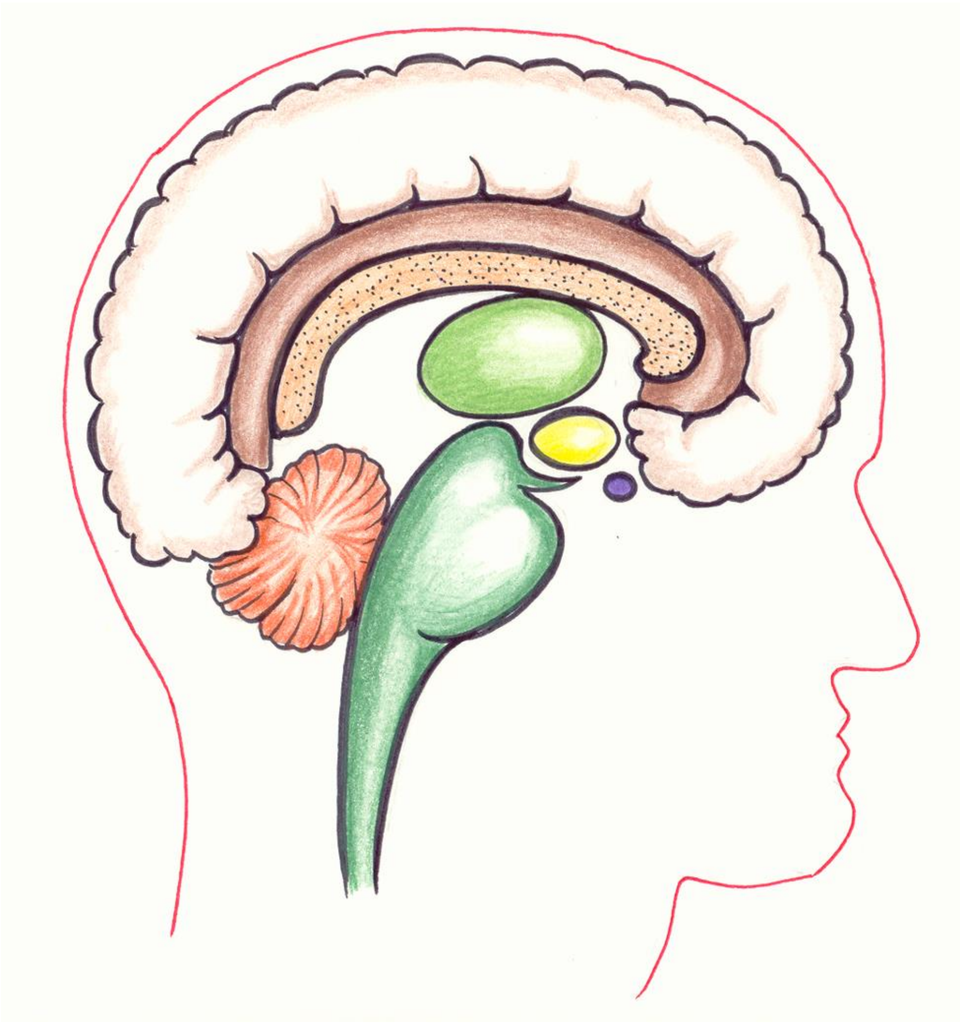
Anatomy of the Brain

Most people nowadays have some idea of what a brain looks like.



As already mentioned, the brain and the spinal cord float in a bath of a liquid called cerebrospinal fluid (CSF).

People often assume that the brain is a solid mass with the spinal cord emerging from its base such a view could not be further from the truth. Beneath that outer covering, there are several other components. The word “brain” is therefore a collective term for this outer covering and all it contains.



The Brain picture shows a cross section of the brain and its component parts. As the spinal cord approaches the brain, it widens out considerably. This part is called the medulla. The medulla is that part of the system which is concerned with breathing, swallowing, digestion and heartbeat.

On the top of the medulla, there is a bulbous structure called the reticular activating system, otherwise known as R.A.S. This is concerned with the arousal system. It determines how wide awake we are. It also activates much of the cerebral cortex, which is discussed later.

This structure is of particular interest to hypnotherapists as it is very much involved during the induction of hypnosis, the aim being to reduce the level of arousal in a patient and help them into an altered state of consciousness.

At the rear of the brainstem, there is a large structure tucked in behind the medulla and the R.A.S This is the cerebellum. It controls muscle tone, body balance and the coordination of voluntary movements.

Since we have already mentioned that lack of coordination is one of the symptoms of multiple sclerosis, it may be wise to point out here that this does not necessarily mean that there is a fault in the cerebellum. The difficulty lies in the fact that the messages sent by the cerebellum are hampered in their journey to remote destinations in the body.

At the front of the brainstem, there is a small structure called the pituitary. This is an endocrine gland which produces, among the other things, a growth hormone which governs the rate of growth in our bodies.

A little above that, there is a slightly larger structure called the hypothalamus. It controls the body temperature, metabolism and the endocrine balance throughout the body. This structure is of interest to hypnotherapists as it is heavily involved in the treatment of eating problems.
The hypothalamus is divided into two sections; the lateral hypothalamus and the ventromedial hypothalamus. The lateral hypothalamus functions like an On/Off switch in that it determines when we start the action of eating and when we stop eating. The ventromedial hypothalamus controls the level of saturation. In other words, it determines when we have eaten enough. So, when we begin to feel hungry, the lateral hypothalamus tells us to start eating. The ventromedial hypothalamus takes over by monitoring how much food is coming in. When enough food has been ingested, the message goes to the lateral hypothalamus to stop eating.

If under hypnosis, the suggestion is given that the person will feel satisfied after eating less, the suggestion will adjust the levels set in the ventromedial hypothalamus.
In other words, the level at which the message is sent to stop eating is lowered.

A little above the hypothalamus is an even larger structure called the thalamus. Surprisingly enough, the thalamus is only a relay station. It is like a telephone switchboard where incoming and outgoing messages are distributed to the correct destinations.

The thalamus is covered by a hood-like structure called the hippocampus. This structure is very much involved, in conjunction with other parts of the brain, in the use of memory.

Surrounding all of these parts is the cerebral cortex. This very large structure controls sensory perception, voluntary movements, learning, remembering, and thinking emotion and consciousness. A very complex and difficult structure to understand.

The cortex is in two halves called hemispheres, one on the left and one on the right. These two halves are joined by a mass of nerve fibres which form the corpus callosum. Neurons to other structures and other parts of the body all pass through here.

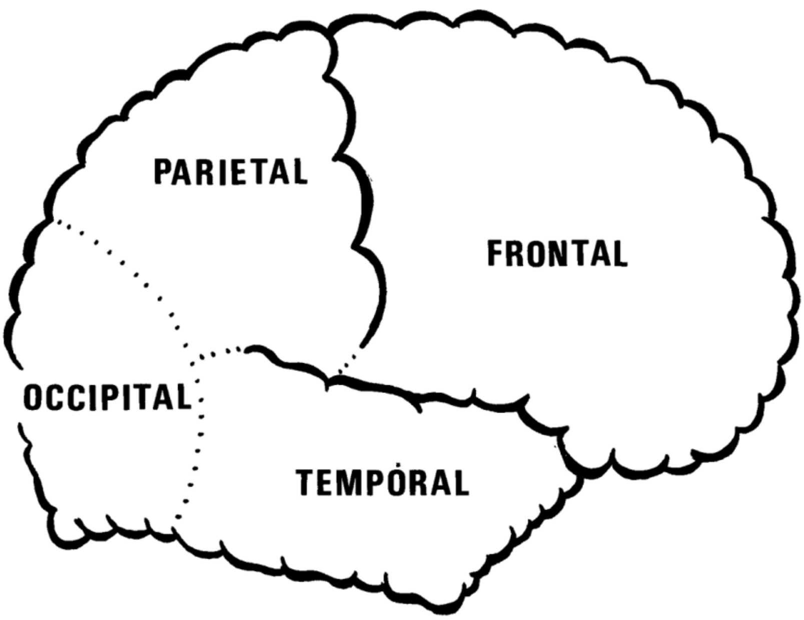
Module 13

The Lobes

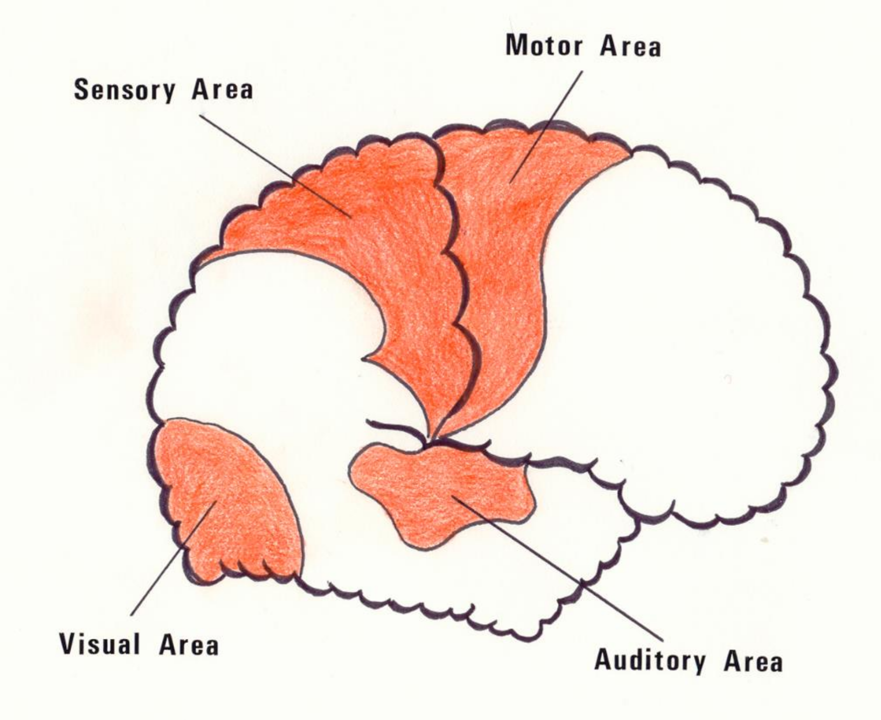
Because of its size and complexity, it is convenient to be able to divide each hemisphere of the cortex into sections. There are two natural landmarks which make an initial division easy. First, there is a large fissure (the central fissure) which runs down from top centre, roughly dividing it in half.

Then there is a second large fissure (the lateral fissure) cutting across almost horizontally in the lower half. These fissures are used to divide each hemisphere into four lobes.

Research has shown that each lobe can be further subdivided into other sections, some of which are common to both hemispheres while others are not. The front lobe contains two such areas.



The olfactory area (not shown) is concerned with the sense of smell. In some animals, this area is very large indeed.



The other area is the motor area. Messages sent from the brain to other parts of the body are sent from here.

Contained in the parietal lobe is the sensory area. All messages sent from sensors in various parts of the body arrive here.

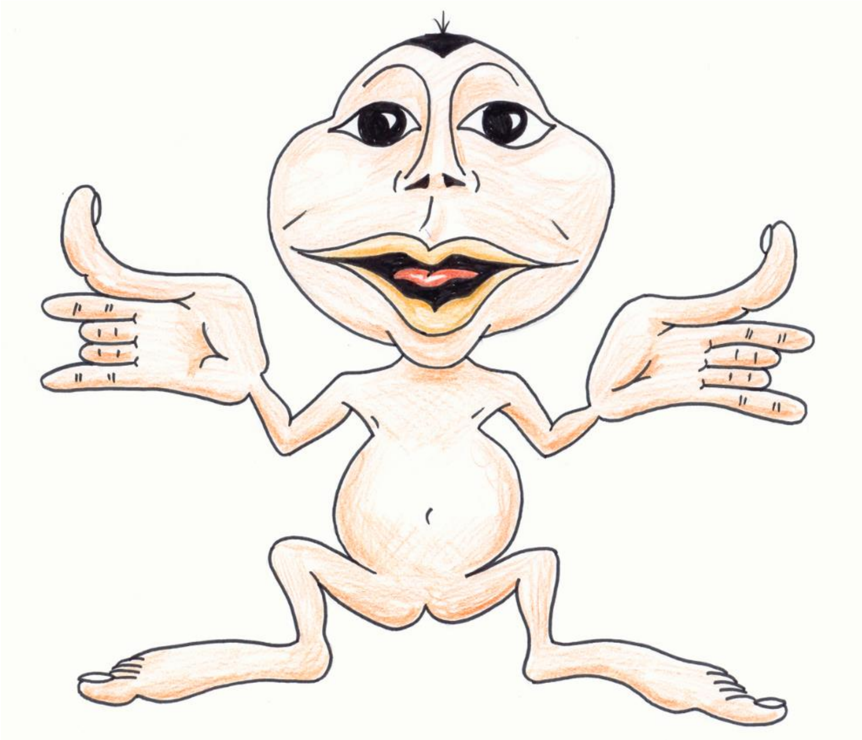
Almost all of the occipital lobe is concerned with vision and visual processing. It should be pointed out here that the word 'vision' refers to that which is seen through the eyes and not that which is seen through the imagination.

Finally, the temporal lobe contains the auditory area, for the processing of perceived sounds.

Returning to the sensory and motor areas for a moment, it is interesting to note that the varying sensitivity of areas of the body is explained by the structure of these areas.
In a very sensitive area of the body, one would expect to find a large number of nerve endings per square inch, with a smaller number in less sensitive areas. This is in fact what we do find.

Victorian scientists produced a drawing of what man would look like if neurons were equally distributed throughout our bodies. The name given to this hypothetical man is homunculus.

Unit 10



In this drawing, that which appears large is very sensitive, while that which appears small is not very sensitive. On this basis, notice the hands. Hands are very sensitive, being involved in the sense of touch, with holding things, griping hard, gently manipulating objects and so on. There needs to be a large number of neurons in this area. Notice especially the size of the thumb: very sensitive. It is also interesting to note that the index and little fingers are shown to be more sensitive than the two in between.

Comparing the hands with the arms, one can see that the arms are much less sensitive. Similar comparisons can be made for other parts of the body.

It should be perhaps pointed out that the homunculus was drawn in Victorian times, there is a noticeably anomaly: one of the most sensitive parts of the body is the genitalia which is conspicuously absent. The uproar its inclusion would have produced in Victorian society could have set back further research for a considerable time.

Unit 10

Module 14

Association Areas

There are sometimes difficulties attached to the consideration of the type of material we are covering here, in that items considered in isolation can give rise to a number of misconceptions. It has been said that “we only use a small portion of our brains”.

Statements like this are completely false and the proper explanation should be understood. After all, if we don’t use them, why do we have them? The body does not waste material like that.

The following lists show the things that are associated with areas of the cortex (the association areas). It should be clearly stated here that this table refers to a right-handed person. In a left-handed person, the table would usually be reversed.

LEFT HEMISPHERE
Writing
Maths
Language
Science

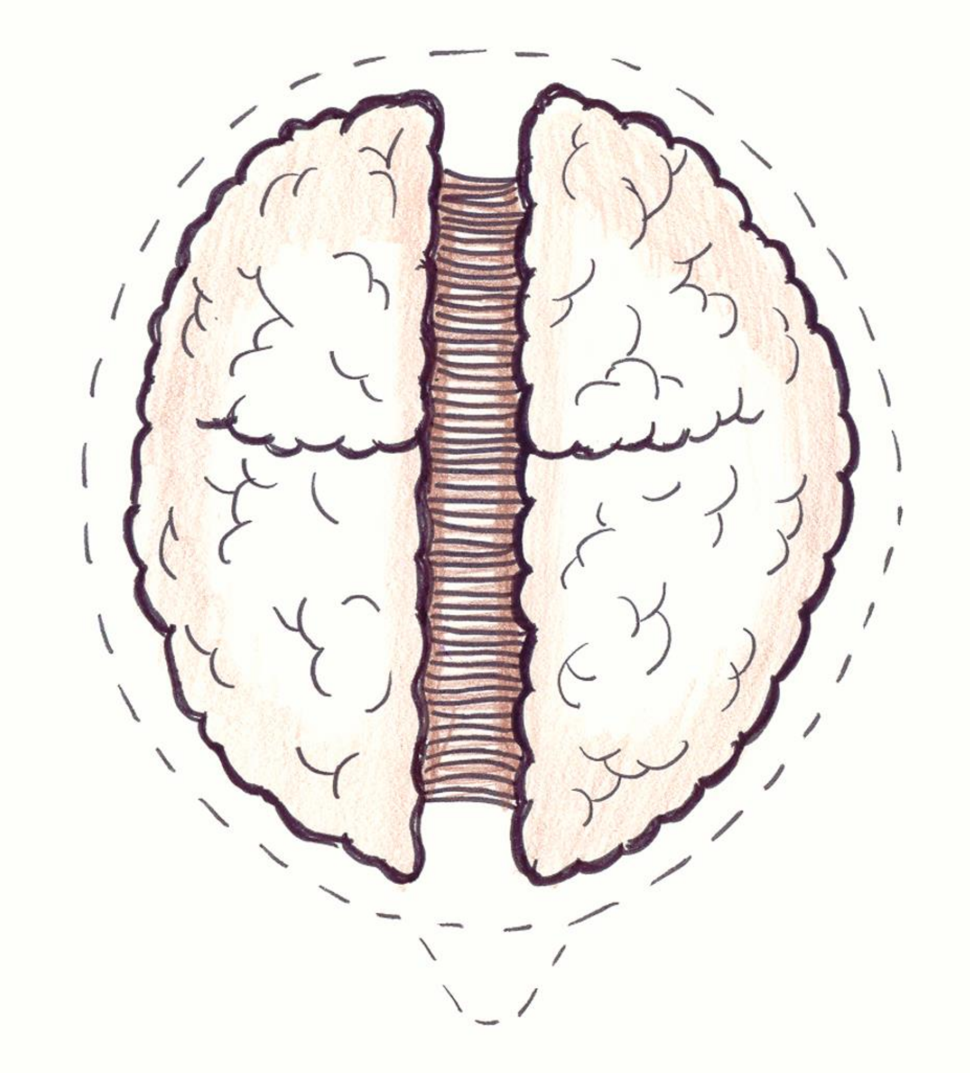
RIGHT HEMISPHERE
Art appreciation
Music appreciation
Dance
Sculpture
Fantasy
Religion

It should be clearly understood that the word “religion” refers not to established religious beliefs but to our esoteric side, whatever that may be. From this, it can be seen that the academic, calculating side is housed in one hemisphere while the cultural, esoteric side is housed in the other.

Module 15

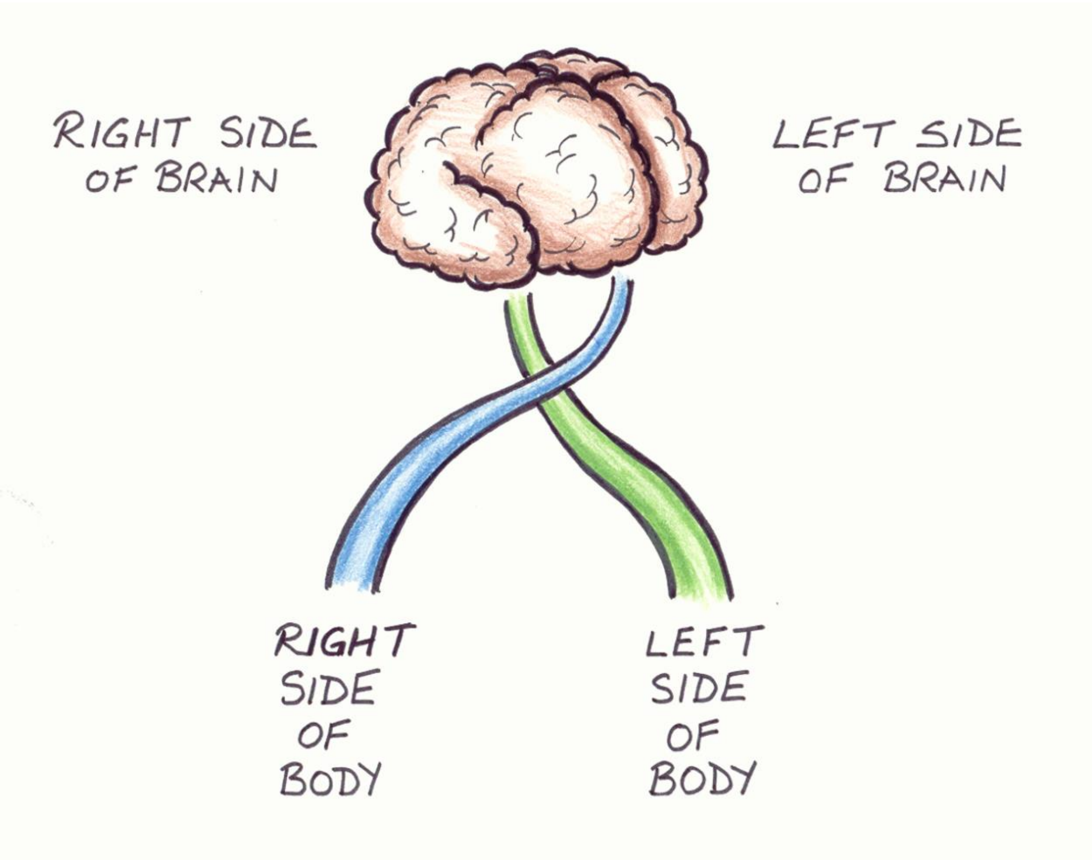
Crossover

Normally, the two hemispheres communicate with each other via the corpus callosum, which is like a bridge of neurons joining the two hemispheres. However, neurons also pass through the corpus callosum on their way to other parts of the body.



The neurons in the brain tend to be arranged in an inside-out, upside-down kind of arrangement. If we map out the neurons in the sensory and motor areas for instance, we find that neurons going to and from the head are located near the lateral fissure. The neurons going to the and from the legs and feet are located at the top of the brain where the two hemispheres meet. In other words, if homunculus were shown superimposed on the sensory and motor areas, he would be upside down.

By the same token, the neurons associated with the left-hand side of the body are found in the right hemisphere and vice versa. These neurons cross over in the corpus callosum.



This is clearly shown by the fact that the paralysis of one side of the body, experienced by many patients who have suffered a stroke, is the result of damage in the hemisphere on the other side of the brain.

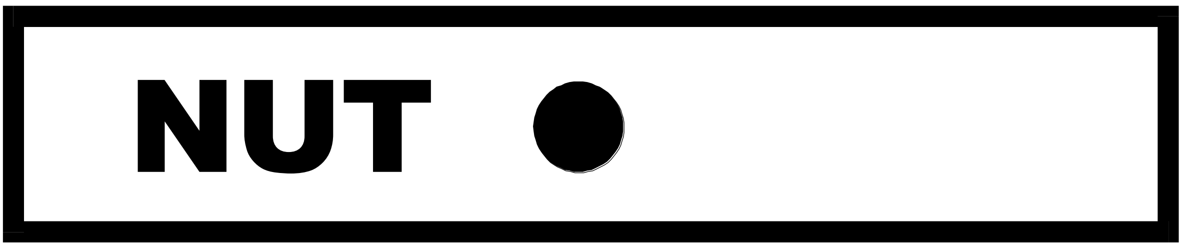
Module 16

Split Brain Studies

Much of the information about the association areas of the brain was acquired through research on a particular type of patient. Many years ago, the treatment that was given for sever cases of epilepsy was to operate on the patient and cut through the corpus callosum. In other words, the two halves of the brain were surgically separated and isolated from each other, which meant, obviously, that impulses could not travel from one hemisphere to the other. Although the people who had this operation benefited from it and were able to conduct a very normal life, many of them were used as subjects for a peculiar series of experiments which we now refer to as “split-brain studies”.

In one test situation, a person with a “split brain” was seated in front of a screen which hid his hands from view. His head was held in a fixed position by resting the chin on a cradle. He was then asked to gaze at one spot in the centre of the screen.

While he was doing this the word “NUT” was flashed, for one tenth of a second, to the left of the spot.



This message, shown to the left side of the screen, would go to the right hand side of the brain. The man in question was unable, very easily, to pick out a nut with his left hand from a pile of objects hidden from view. However, he would not tell the experimenter which word was flashed on the screen. Language depends on the left hemisphere and the visual image of the word “NUT” was not transmitted to that side.

When he was questioned, he seemed completely unaware of what his left hand was doing during this experiment. Since the sensory input from the left hand goes to the right hemisphere, the left hemisphere received no information about what the left hand was doing or feeling. All the information was fed back to the right hemisphere which received the original input.

In conduction experiments of this kind, the amount of time that the word remains on the screen is very important. If it remains any longer than one tenth of a second, the subject can move its eye’s freely, then the information is going to both hemispheres.

In a similar experiment, the word “HATBAND” was flashed onto the screen, so that the word “HAT” went to the right hemisphere and the word “BAND” to the left hemisphere. When that person was asked what the saw he replied “band”. When asked what kind of band, he made all sorts of guesses- rubber band, rock band, and so on. He would only hit on the correct word by chance.

HAT ● BAND

Tests with other words like “KEYCASE” and “SUITCASE”, projected in this same way, produced similar results. What is perceived by the right hemisphere does not transfer over to the left into conscious awareness of the split-brain subject. With the corpus callosum severed, each hemisphere seems totally oblivious of the experiences of the other.

If a split-brain subject is blindfolded and a familiar object, such as a comb, toothbrush, or key case is placed in his left hand, he appears to know what it is. For example, he can demonstrate its use by appropriate gestures. But he cannot express this knowledge in his speech. If asked what is going on while he is manipulating the object, he has no idea.

This is true as long as any sensory input from the object to the left hemisphere is blocked. But if the subject’s right hand inadvertently touches the object, or it makes a characteristic sound, like the jingling of keys, then the speaking hemisphere immediately gives the right answer.

Experiments like these have taught us that, when it comes to function, the two hemispheres are quite different, even though the looks like mirror images of each other.

Module 17

The Need to Know

Thus far, we have been considering the nuts and bolts of the nervous system and now have some idea of the complexity of it. To some people, this may come under the heading of "so what" data and they may ask what all this has to do with hypnotherapy. The answer is very basic. Hypnotherapy deals with reality. The therapist should realise that although the therapy is aimed at the mind, it alters the chemistry of the nervous system. When the mind performs an action, no matter how trivial, the first tangible evidence we have that anything has happened is that a chemical is realised in the brain.

One thought will cause a set of neurons to release their neurotransmitters. Hearing one spoken word will also activate neurons. In other words, hypnotherapy is not just a "psychological" therapy: it is also a physical therapy. Suggestions produce physical changes.

To take this principle to its extreme, we could also follow other lines of logic. Spoken words will produce activity in the auditory areas of the temporal lobes. This will be fed back up to the mind for processing, also producing activity in the association areas. The way in which this information is processed in the mind will determine what will result as the chemical status of the nervous system, which in turn will have its effect on the physical body.

If a person is continuously exposed to negative input to the extent that they begin to think habitually in a depressing way, then this will cause certain neurons to fire. As already discussed, neurotransmitters are specific to the job the neurons have to do. Therefore, a very specific chemical will be found in abundance in the brain.

On the other hand, if the input is positive, and the person is habitually cheerful, a completely different set of chemicals are involved. The spoken word is therefore a powerful thing. It alters the chemistry of the brain and produces positive or negative effects. IT IS VITAL THAT THEREPISTS OF ANY KIND BE AWARE OF THIS. EVERY WORD SPOKEN IN THE PRESENCE OF A PATIENT, WHETHER HYPNOSIS IS INVOLVED OR NOT, SHOULD BE VERY POSITIVE IN NATURE. If negativity is not removed, it could actually cause more damage. On the other hand, positive conversation actually assists the healing processes.

To help this understanding, we are now going to consider a particular piece of research carried out in 1978.

Module 18

A Research Project

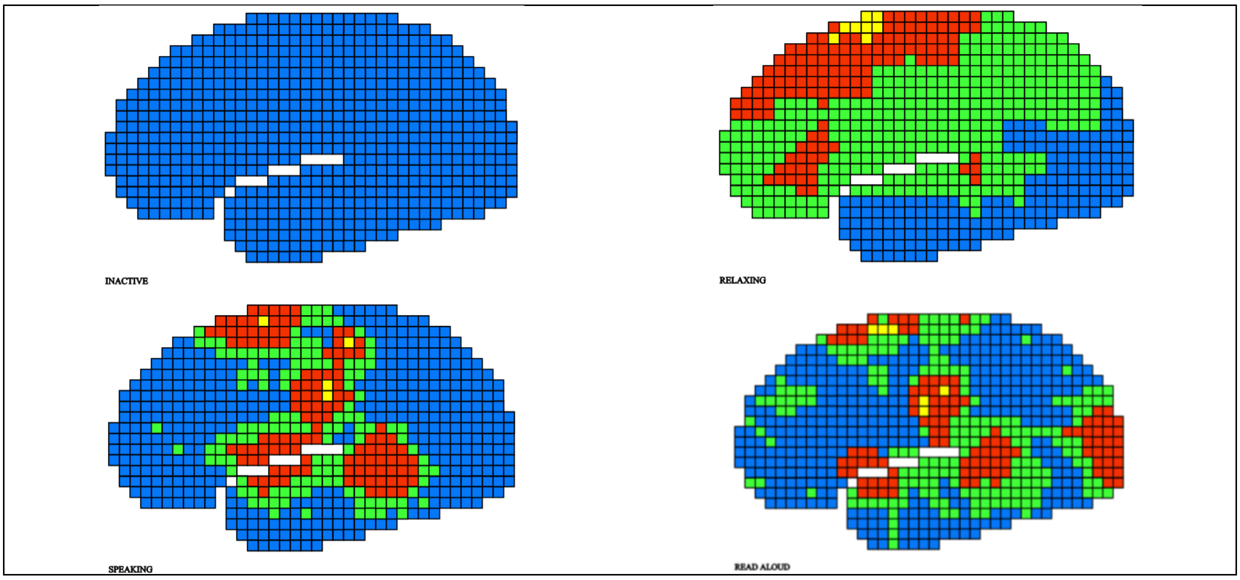
The thought behind this piece of Research is that an active neuron burns energy, which has to be replaced immediately. One way to do this is through the intake of oxygen which is carried by the bloodstream. One would therefore expect that the blood supply would be more plentiful in active areas of the brain than anywhere else. By tracing the blood supply, one ought to be able to find out which areas of the brain are active and which are un-active. This was the basis of the project.

In order to trace the blood flow, the experimenters prepared a dilute solution containing small quantities of a radioactive isotope called xenon 133. This solution was to be injected into the carotid artery of the experimental subject. The person thus injected sat resting the side of his head against a device containing a bank of scanners, capable of detecting the presence and density of the isotope. By setting it up this way, it was possible to find out where the blood supply was being sent throughout one complete hemisphere of the brain. The scanners were connected to a computer which displayed the information on a screen in the form of coloured pixels. The colours indicated the density of the isotope, as follows:

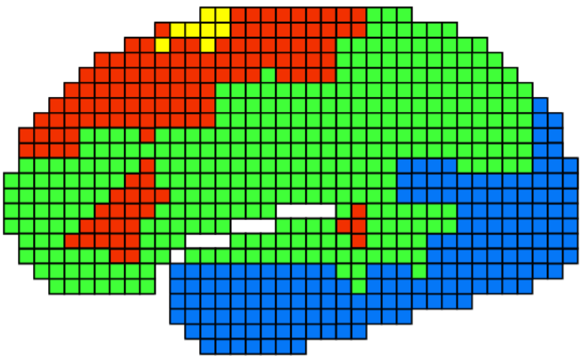
- Blue-very little activity
- Green-an average amount
- Red-a lot of activity
- Yellow-intense activity

The screen thus displayed a picture, showing the outline of the brain and indicating where the activity was taking place.

Some of the results of the experiment are shown in the Brain diagrams below. In each case, the injected subject was asked to carry out the indicated activity.



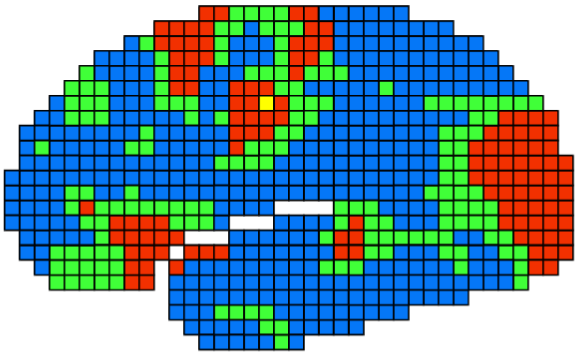
It is easy to see that the four examples shown are quite different. It may perhaps come as a surprise to notice the amount of brain activity associated with relaxation.



RELAXING

The subject here has his eyes closed. Hence almost the entire occipital lobe is blue. There is a red patch in the temporal lobe, which is the auditory area. The subject's eyes are closed but he is still listening. Similarly, the olfactory area (to do with smell) is red. Parts of the sensory and motor areas are red; particularly those associated with the lower half of the body. However, notice that certain of the association areas are red too, adding weight to the argument that these areas of the brain are used. The subject may be relaxing but he is still thinking his private thoughts. The rest of the brain is mainly green, showing an average amount of activity.

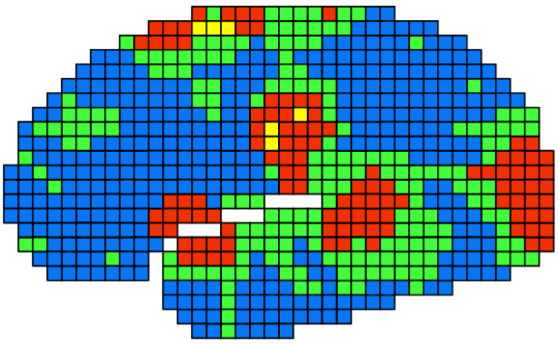
If we now compare this with a subject who is asked to read silently, some dramatic changes have occurred.



READ SILENTLY

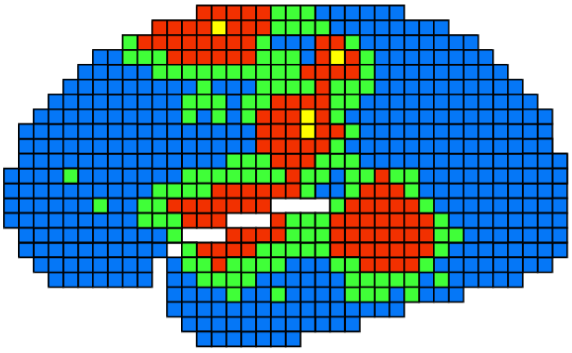
Rather than an overall activity, we find that some areas have been shut down, while others have been activated, as the eyes are open, the occipital lobe is now red and green. The auditory and olfactory areas are still active. The sensory/motor areas associated with eye and head movement are red, showing intense activity in one part. Also, one part of the association area is red. Apart from these areas, the rest of the brain is blue. It would therefore appear that any part of the brain not in use during a particular activity is bought to rest.

When the subject reads aloud, the auditory area is more active. Obviously, one listens to what one says. Also, there is more activity in the motor area, since the mouth and vocal cords have to be operated.



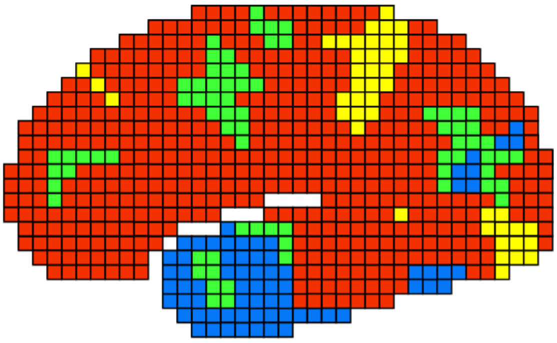
READ ALOUD

A similar picture appears when the subject is simply speaking. Those areas are associated with this activity are highlighted, while others are shut down.



SPEAKING

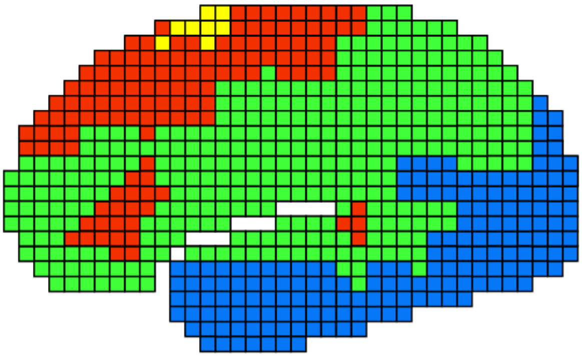
Compare this now with another picture. This shows what happens in the brain of a subject who is emotionally aroused. The predominant colour is red, reflecting the intensity of the neuronal activity associated with a condition like this. There is also much more yellow than in the other pictures.



EMOTIONALLY AROUSED

An aroused person is more aware of their surroundings. The eyes are studying intensely and processing more visual information. Consequently, the occipital lobe shows a great deal of intense activity. The imagination is also very active in such a person and the mind turns cartwheels. Consequently, yellow in association areas. It is easy to see that this is a person with a problem.

However, if we compare this with the picture of relaxation, the activated areas are roughly the same. It is simply the colours that differ. If such a person were to enter hypnosis, the colours would change from red to green, indicating a state in which suggestions could be effectively given.



RELAXING

Module 19

The Implications of this Research

It should now be apparent that there is a physical side to any psychological problem. It should also be clear that while this relationship can be used, the ultimate cure for a psychological problem lies in the mind, not in the brain, which merely reflects the minds activity. The truth of this statement becomes evident when we compare the effects of different therapies.

One of the main agents used by the medical profession in the treatment of psychological problems is the psychoactive drug. As we have already discussed, the molecules of these drugs are small enough for them to pass from the bloodstream into the synaptic clefts between neurons. The important point to notice is that the drugs are transported by the bloodstream.

The research discussed above shows that the blood distribution in the brain varies according to the activity being engaged in at any given moment. This means there is no guarantee that the drug will go to its intended destination unless the patient is told what activity to engage in when the drug is taken. If the drug goes to the wrong place, there is always the chance that it will fire other neurons instead, producing the wrong reaction in the body. This makes it easy to understand what is meant by “side effects”. The big problem with this method of treatment is that the brain is flooded with the drug. Some of it may go where it was intended, but some of it will surely go to entirely inappropriate destinations.

If we compare this with the acupuncture, we find an immediate improvement, for instance, the insertion of a needle in the leg will send an impulse up to a very specific site in the brain. One result of this could be that, in that area of the brain, an endorphin is released which will settle on its receptor to bring about pain relief and a feeling of well-being. The main point in favour of this approach is that the brain is not flooded. The reaction only occurs where it is intended to occur and nowhere else. Coupled with this fact that the patient does not have to be engaged in some specific activity for this to occur. It is therefore a much better approach.

The problem with both these approaches is that they are concerned with symptoms and not causes and that they are intrusive in their nature. Hypnotherapy on the other hand, is not like this. The cause of the problem is not in the brain, it is in the body does not have to be invaded with drugs or needles, or anything else. The cause can be established and dealt with and the symptoms removed at source. Since the spoken word produces changes in the brain, this tool can be used to make the brain produce specific chemicals at specific sites, again without asking the patient to engage in a particular activity.

This research gives the hypnotherapist confidence that this form of therapy is not just a flight of fancy, or a confidence trick. This is reality. The therapy influences the mind. This produces chemical changes in the body. Hypnotherapy can be used to bring about changes anywhere in this chain, of command, making it very valuable therapy indeed.

Students might find it an interesting exercise to think about this research project and its implications in greater depth. For instance, what would you imagine to be changes that would take place in the brain as one progressed through a hypnotic induction? What changes take place when you help someone to stop smoking? The questions are endless, but thinking about them in this context opens the mind to the possibilities that lie before us in the field of hypnotherapy.

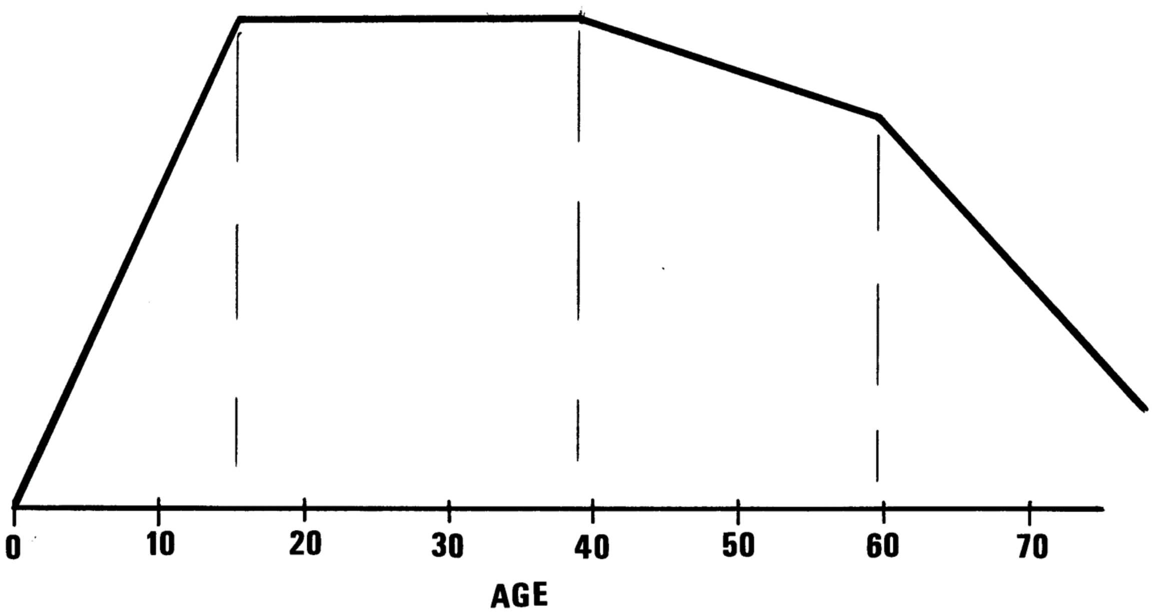
Unit 10

Module 20

Interpreting Data

A final word on the study of neurobiology concerns the interpretation of statistical data. This principle discussed here applies to all applications where statistics are involved.

The graph shown below, concerns the number of neurons a person has at any given age.



From this is can be seen that one is making neurons (building a brain and nervous system) right through to middle/late teenage. At this age, the system is complete and no more neurons are made. One maintains this level until the approximate age of 40, when neurons start to die off. These neurons are not replaced. The rate of loss remains low until around the age of 60, when the deterioration rate accelerates, and neurons die at a faster rate.

The first thing to notice is that this is general statement. The ages are approximate.

Secondly, this is about the number of neurons one has at any given time, and that is all. It is not a statement about mental faculties, or anything else.

Unfortunately, a few members of the medical profession who should know better have misinterpreted this graph on several occasions. For instance, it has been used as an explanation for senile dementia. The statement they make is that once past 40, you begin to lose your faculties, and this will lead to this condition.

Nothing could be further from the truth. Senile dementia has nothing to do with how many neurons one has. It involves other things. If it were true, then everyone over the age of, say, 70 would be a sufferer.

The loss of neurons does not mean an increase in any of a number of psychological conditions. If anything, it means a gentle slowing down. To run an enormous program on a computer with a large memory is easy. To run that same program on a computer with a smaller memory would involve breaking it down into two or three programs. It would still run, but it would take longer. This is the same effect that a lower number of neurons has on an individual.

Neither does it affect the intelligence. This is demonstrated by the higher than expected number of senior citizens who qualify for membership of Mensa (the high IQ society).

Memory is also not affected by this. Senior citizens often enjoy remembering events from their past, including their childhood, the war years, and so on. Their performance shows the lack of correlation between memory and number of neurons.

The danger with statistics is not the results that are published. It lies in the way those results are interpreted. Therapists should be very aware of this when considering any data concerning health subjects.