



wellways helping families & friends find better ways

Understanding the Brain and Mental Illness

The biological basis of mental illness

Mental illness is, in part, an illness of the brain. Learning about the brain can:

- give information from a biological and medical perspective (and some idea of its complexity)
- help you understand and support treatment
- assist you in dealing with the stigmas of mental illness
- support the realisation that no one is to blame for the onset of mental illness.

About brain research

A lot of what the community commonly thinks and knows about mental illness is based on previous experience and social stigma. It is often information that is out of date and leaves us with an impression of hopelessness. In fact:

- Over half of what we know about the brain in relation to mental illness we have learnt in the last 10 years. As a consequence, medications and treatments have improved significantly and people who are now being diagnosed with mental illness have a better prognosis than people diagnosed before that time.
- New imaging technology allows the brain to be examined while the person is experiencing mental illness, whereas before we relied on autopsy information.

- Research indicates that physical changes commonly occur within the brain in mental illness.
- The brain pathways responsible for 'higher' mental functioning (feeling emotions, interpreting information) are affected.
- The linking of an illness to particular changes in the brain is extremely difficult. (Brain scanning techniques are used alongside assessment of behaviour and symptoms.)
- Brain research has already achieved much, and has further capacity to improve medications and other physical treatments.

What changes in the brain when mental illness is present?

Like other body parts, the brain is susceptible to injury and change.

Both the chemical messaging system and the physical structures of the brain can be altered in mental illness.

The chemical, or neurotransmission system in the brain

Neurons

The brain is made up of billions of cells called neurons.

Each neuron is a link in a chain and can have thousands of connections to other neurons.

These connections of neurons form chains through which messages are relayed in the brain.

Synapses

The synapse is the meeting point of two neurons. A signal must be transmitted from one neuron across the synapse to the other neuron. These events occur within milliseconds.

Neurotransmitters

- Neurotransmitters are the chemicals that conduct the messages across the synapse.
- When a signal arrives at the end of a neuron, the neurotransmitter spills into the gap and crosses the gap.
- Scientists have identified over 50 neurotransmitters that are messengers communicating information from one part of the brain to another, and to all parts of the body.
- From this simple system, complicated brains are built. And this system seems affected in many mental illnesses.

Neurotransmitter malfunctions can occur because there is:

- not enough neurotransmitter
- too much neurotransmitter
- malabsorption of the neurotransmitter.

Some important neurotransmitters and their roles are:

- dopamine: activation level, mood, movement

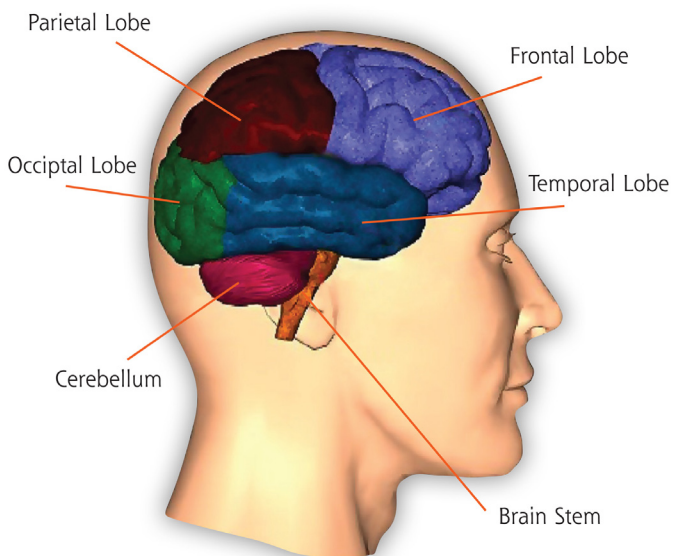
Understanding the Brain and Mental Illness continued...

- norepinephrine: mood, activation level
- serotonin: mood, sleep, appetite, aggression
- acetylcholine: mood, autonomic nervous system.

Malfunction in these neurotransmitters is found in many forms of mental illness. It is possible that, in biologically vulnerable individuals, high stress levels 'trigger' malfunctioning in neurotransmitters (e.g. production of neurotransmitters cannot keep up with the body's demands or the neurotransmitters are not effectively removed from the system).

Brain structures

There is evidence to strongly suggest that some brain structures are altered or damaged in mental illness. It is clear, however, that many parts of the brain are affected by mental illness, including the following:

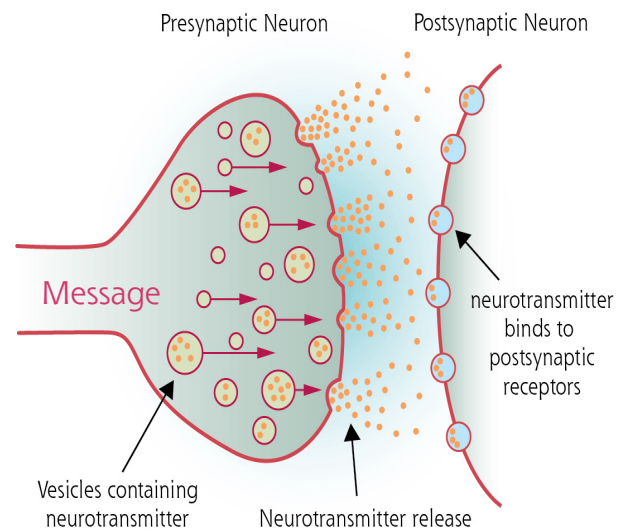


Frontal lobe

The main purpose of the frontal lobe is control of movement (co-ordination).

It is also thought to be responsible for behaviour, character, emotional state, short-term memory and planning.

Think of the behaviours that are often displayed when someone is psychotic. They often have poor concentration, they can be emotional or lack emotion and display odd behaviours. Movement can also be random and disjointed.



Parietal lobe

The parietal lobe is involved in:

- long-term memory
- obtaining and retaining accurate knowledge of objects
- sensory speech (responsible for perceiving the spoken word).

When a person develops certain mental illnesses, these pathways/speech may be affected. Hence someone with schizophrenia, when psychotic, may develop a language of their own or words of their own, called neologisms. Often people's ability to retain information is limited.

Temporal lobe

Roles of the temporal lobe include:

- auditory (hearing), the area that receives and interprets impulses from the inner ear
- olfactory (smell), the area that receives and interprets impulses from the nose
- taste, the area that interprets nerve impulses from the tongue.

The cells in this area receive and interpret impulses from the various parts of the body, i.e. nose, taste buds and ear. When someone is psychotic they may be hearing voices, but the parts of the ear usually involved in hearing (the anvil hammer, etc.) are not physically moving from sound waves. However, the impulses in the brain are working and sending messages, as if the person is hearing. This also occurs in relation to smell and taste – people may think the food is being poisoned because it tastes different.

Occipital lobe

The occipital lobe receives impulses from the eye and interprets them as visual impressions. The eyes do not actually do the seeing – it is the brain that receives the impulses from the eyes and interprets them. When someone experiences visual hallucinations, the occipital lobe is seen to be very active – impulses are interpreted and processed – thus the person sees objects that may not be present.

Basal ganglia

Thought to influence muscle tone – if control is inadequate, movements are uncoordinated.

Thalamus

Receives impulses from the body's sensory nerves associated with pain, temperature, pressure and touch. Here crude, uncritical sensations reach consciousness (e.g. awareness of pain but not the ability to identify the body part involved). People with schizophrenia may wear lots of clothes on hot days because this part of their brain is affected by the illness.

Hypothalamus

Involved in the pituitary gland's orchestration of hormone release and in the autonomic nervous system (hunger, thirst, body temperature, heart and blood vessels, and defensive reactions such as fear and rage).

The cerebellum

- Controls and co-ordinates the movements of various muscle groups to ensure smooth, even and precise actions.
- Maintains balance and equilibrium of the body.
- Jerky, unco-ordinated movements indicate the involvement of the cerebellum in mental illness.

The limbic system

- Is more a functional than an anatomical entity.
- Involves parts of the brain essential for organising emotional responses and processing information.
- Is involved in schizophrenia, which affects the emotions of the person and their ability to process information.

Applying the knowledge – theories about what happens in the brain relating to schizophrenia, depression and obsessive compulsive disorder

Schizophrenia

Current research indicates the following theories about what is happening in the brain in relation to schizophrenia:

There is an excess of the neurotransmitter dopamine. Dopamine is involved in regulating thoughts and feelings, both of which are disturbed in schizophrenia. It is also thought that high dopamine levels make someone more sensitive to stress.

Research indicates that some people with schizophrenia appear to have larger ventricles.

Research also indicates that some people experiencing schizophrenia seem to have a loss of tissue in the anterior hippocampus, which may account for memory problems and irrationality. Recent research carried out in Melbourne seems to indicate some people have this tissue reduction before the onset of psychosis, which leads to the hope that results of Magnetic Resonance Imaging (MRI) can be used as a predictor of schizophrenia.

Depression

In depression, not enough neurotransmitter appears to be released into the gap between neurons, or too much of it is removed before it has completed its function.

When antidepressants are used, there is more neurotransmitter available in the gap between neurons, which eases a depressed mood.

Obsessive compulsive disorder

Researchers think obsessive compulsive disorder (OCD) may be linked to parts of the basal ganglia involved in fixed patterns of behaviour resulting in an imbalance among a variety of neurotransmitters.

One hypothesis is that the brain signals for a contaminant (like dirty hands) cause the cortex to send signals to pre-programmed cells in an area of the basal ganglia that produce the neurotransmitter serotonin, with other neurotransmitters also involved.

Conclusion

In short, we provide this basic information about the brain and mental illness for the following reasons:

To increase your familiarity with the terms so that when they are described by people in the treating profession, you might recognise them and be able to engage in a discussion that is fruitful for you.

For you to understand more about some of the behaviours associated with mental illness and their origins.

Because our experience is that many families when they first come into contact with mental illness believe that it is due solely to a negative psychological experience early in life (that the family may have caused). More information about the biological origins of mental illness gives you an opportunity to revisit these ideas.



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