

A brain scan to tell if you're depressed—and what treatment is needed

March 29 2017, by Cynthia Fu



Credit: Tima Miroshnichenko from Pexels

We currently diagnose depression based on what individuals tell us about their feelings – or those of their loved ones. People with depression usually describe feeling sad or say they are unable to enjoy the things

they used to. But in many cases they don't actually realise that they are clinically depressed – or feel uncomfortable talking to a health professional about it.

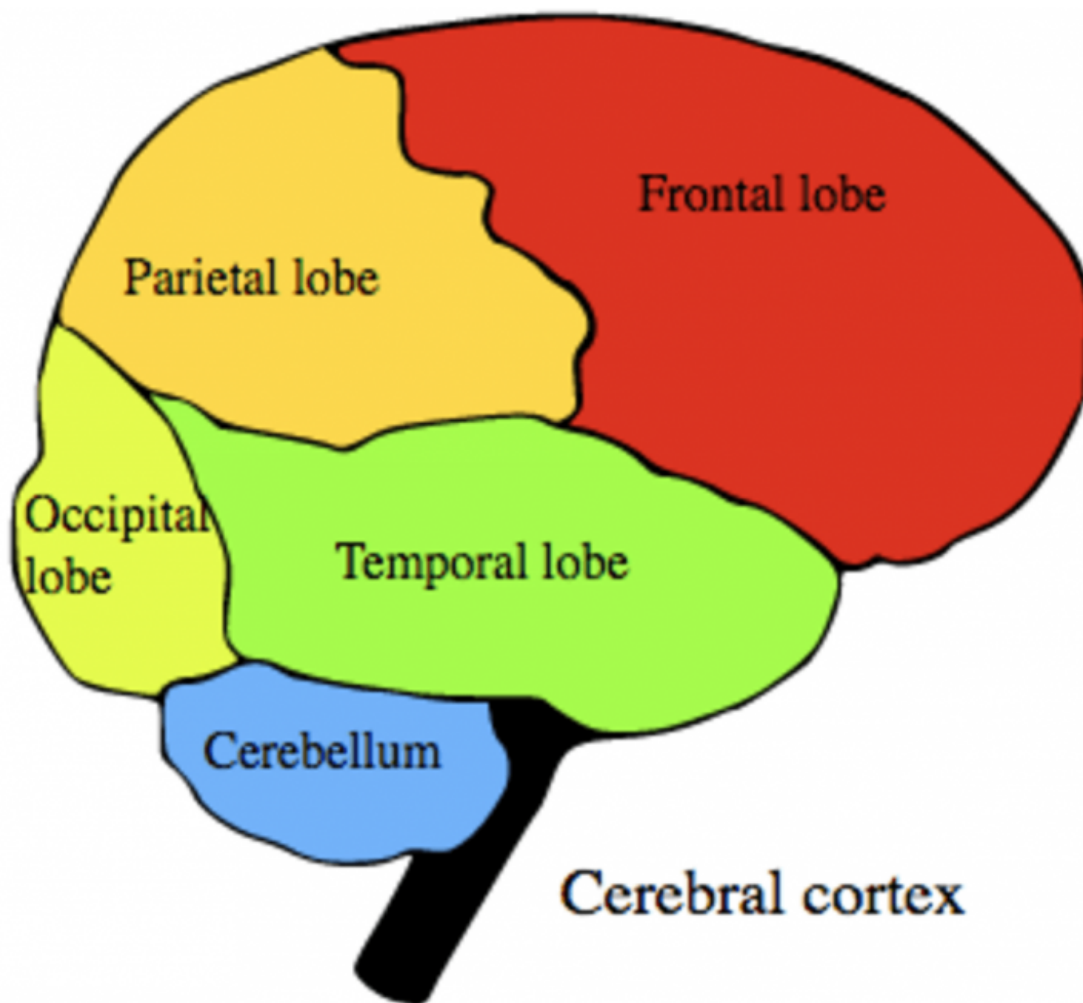
Such cases pose an important problem as untreated depression can hugely interfere with someone's life, [significantly increasing the risk of suicide](#). Currently, it is difficult to help [people](#) who are not able or willing to communicate how they feel, as there are no biological markers for the condition. But we have [managed to identify](#) a network of brain regions that is affected in people with depression – raising hope that brain scans could soon be used to diagnose it.

Depression has been recognised as an illness for centuries and was [initially called melancholia](#) – then believed to be caused by an excess of "black bile". We now recognise that there are genetic as well as environmental factors that increase the risk of depression. For example, it occurs more frequently in certain families and in children who have suffered from abuse. We are also beginning to identify genes that are associated with the development of depression.

There are several [physical symptoms of depression](#) including a reduction in appetite and weight loss. But the trouble is that these could be caused by a variety of conditions. Also, people can be affected in different ways – some may notice an increase rather than a decrease in appetite, for example.

Problems with sleep are also common. Many people wake up in the middle of the night and then have trouble getting back to sleep. Others may be sleeping more than they usually do. Further symptoms include losing interest in doing things, a [reduction in libido](#), a lack of energy and [finding it difficult to concentrate](#). Some people start over-thinking things, feeling guilty or even begin wishing they were dead.

While we have all experienced feeling low at some point in our lives, what is distinct in depression is how long these symptoms continue for and how bad they can become. They are often experienced as unrelenting.



The network identified in depressed people involves many different brain regions. Credit: wikipedia

The depressed brain

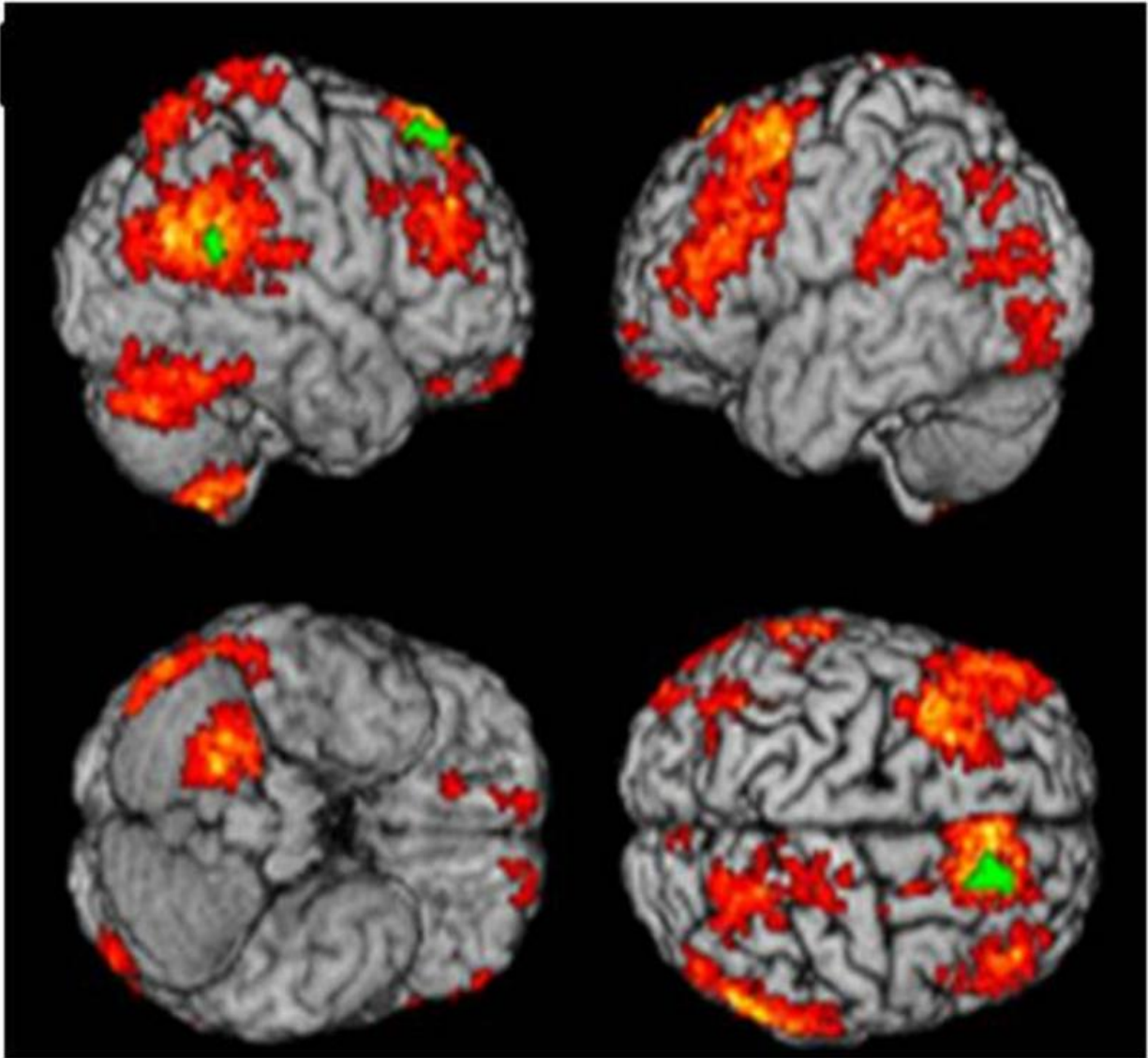
We have been studying the brain regions affected by depression for some time. For example, we have already identified [widespread reductions in brain tissue known as grey matter](#) in the limbic lobe (supporting functions including emotion, behaviour and motivation) and prefrontal regions (involved in planning complex cognitive behaviour and decision making) in depressed people.

Most previous research has looked at overall differences between groups of people with depression and groups of healthy volunteers. We did something different. We identified the pattern of brain regions that is most commonly found in our group of patients with depression. We then asked whether the same pattern could be found in another person and whether it would indicate that they were also suffering from depression.

To do this, we applied a form of analysis called machine learning, which refers to algorithms developed from statistical learning theory and artificial intelligence. It works by recognising patterns in data and learning from these patterns to make predictions in new data sets. The data came from structural [magnetic resonance imaging](#) (MRI) scans (which use [strong magnetic fields](#) map the location of water and fat in the body) in 23 adults with [major depressive disorder](#) and 20 matched healthy individuals.

We found that there is a widespread network of brain regions which includes specific density variations in both grey and white matter, extending from the prefrontal areas of the brain to parietal lobes (which integrate sensory information), as well as occipital (involved in visual processing) and cerebellar (centre for motor control) regions – in patients with depression. We were able to [match the exact same pattern](#) of brain regions in other people who were also experiencing depression.

The study, published in BJPsych, tells us that there is an underlying brain structure in depression and that we may be able to use this information to help us to make a diagnosis.



Grey matter patterns in depression. Author provided

We also looked at whether we could use the same pattern of regions in

individuals with different ethnicity. This is because there is some evidence that there are [distinct neural responses](#) in people with different ethnicity in particular situations. But we found that the same pattern of regions appears to underlie depression in individuals with different ethnic backgrounds – adding further hope that we have indeed found a true biological marker for depression.

We also looked at whether we could predict if someone's depression [would respond to an antidepressant medication](#) or to a talking therapy. Although we have guidelines about how to start particular therapies, we are not able to say, for a specific patient, how likely the therapy will be to help their depression. But we found that there are specific patterns of [brain](#) regions which distinguish how well someone's depression will improve with antidepressant medication or, alternatively, to a talking therapy.

The pattern of regions that indicated whether a patient would experience a good response to pharmacological treatment included a greater density of grey matter in areas which help link behavioural outcomes to motivation, among other things. However, participants who were at risk of having residual symptoms would instead have a greater [grey matter](#) density in areas involved in the processing reward value. Based on this pattern, we were able to say that there was at least an 80% likelihood that a certain patient would respond to [antidepressant medication](#) (in some cases even higher).

The scan itself took about ten minutes and the participants did not have to be doing anything in the scanner. Although promising, MRI scanners are currently not widely available. Also, not everyone can have an MRI scan (for instance if you have a pacemaker). In order for this to be used in day-to-day clinical care, we would also need to distinguish the [pattern](#) of [brain regions](#) that is specific for [depression](#) from other disorders, such as bipolar disorder and schizophrenia, which [could have distinct](#)

[networks of brain regions.](#)

But the good news is that the study is supported by other research which has similarly found that structural [MRI scans could be diagnostic for depression](#). The next step is to replicate and generalise these specific findings.

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Provided by The Conversation

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