COVID-19 has had major impacts on the economy, the way we live our daily lives, and our mental health. The research on mental health during COVID-19 has mostly focused on frontline healthcare workers, with good reason, but all of us are experiencing some level of increased stress right now. There are more obvious sources of stress in the current situation, such as having a loved one who is ill with coronavirus, dealing with financial hardship due to loss of a job, or figuring out how to take on the new task of homeschooling children while maintaining a job, sometimes in a new environment. There are also less obvious but still very real sources of stress, such as converting much of our communication to videoconferencing platforms, which make it more challenging to read non-verbal cues and hear certain frequencies, thus making social interaction more energy intensive. Just as there are a diversity of sources of stress, so too are there a diversity of ways we that we process and react to stress.

Dr. Leanne Williams, founder of the Stanford Center for Precision Mental Health and Wellness (PMHW), and her lab have focused their work on what happens in times of extreme negative stress, such as the current situation. Stress in itself isn’t bad — and in fact some kinds of stress are positive, such as stress associated with an ambitious project that’s important to you that pushes you to achieve these goals, and in turn, build confidence and advance in your field. But when negative stress becomes cumulative, we may experience a “short circuit” in the parts of our brain responsible for thoughts and emotions and become stuck in a loop. These short circuits aren’t a form of weakness or a personality flaw — they’re biology interacting with our experience. And everyone experiences them at some point.

So how does this connect to our mental health? Working towards diagnostic technology and testing for mental health and better understanding the brain, we are using high-definition MRI technology. We’ve studied these short circuits and identified six distinct ways that brain circuits, which are each responsible for a particular set of mental health symptoms, can get disrupted or stuck, which we call biotypes. In situations where you have persistent negative stress that you don’t feel you can control such as the current pandemic, constant pressure will be put on your
brain circuits. If you can't find a way to adapt to the stress, your brain circuits will get more and more pressured and eventually become stuck. That state of being stuck and feeling like there isn't a way out or a way to think around it is effectively what we call clinical depression or clinical anxiety disorder. In those situations, it may be very hard to be productive or maintain relationships.

We tend to think of depression as a monolithic thing, but just as there are different types of cancer, each with its own symptoms and course of treatment, there are different types of depression. Understanding these biotypes — which are effectively the different ways that negative stress can express itself — gives us a way to actually understand our own brain, and we believe that is our best asset.

Mental health is just like any other aspect of health and just as we think about what foods we feed our body, we need to think about what we feed our brain. What information do we give it, what do we focus on, how do we train it and how do we seek out positive stress that helps us build resilience and learn strategies for managing the negative stress? We believe the more that you understand the answers to these questions, and about your own brain in general, the better you are equipped to be in a state of prevention and live the optimized life that you want.

A person may worry excessively, find it hard to focus, or tend to dwell on a negative experience over and over. If someone recognizes themselves in a biotype, that may be their style of reacting to negative stress, and it wouldn't necessarily mean that they’re in clinical depression. But it can be an important step toward learning about how their brain functions. When we can name the challenge we’re struggling with, we’re that much closer to addressing it; it’s empowering to understand how our own brain works.

Listed below are the six biotypes, the brain circuit that most defines them, and some of the thoughts, emotions, and behaviors implicated in each. We have first listed the three biotypes that we believe may be most impacted by the current situation and common-sense tips for dealing with symptoms that may arise.

“Rumination”
● Involves the brain’s default circuit
● Tendency to repeatedly worry and have negative thoughts from your inner voice
• Repeated negative self-talk can create internal tension and disrupt social and workplace function
• Associated with a greater activation of health concerns. Prior work has found that individuals with a ruminative style will be more likely to more likely to internalize broad health concerns discussed in public into their own experience and memory, which may in turn make them feel more personally more vulnerable and anxious.
• A common-sense tip that is suggested by this research is for those that have a ruminative style to limit their exposure to media/related information that could be a repeated source of general and alarming information without context and focus on constrained and regularly structured sources of the most factual information. For instance, if you find yourself overwhelmed by the news, you could select a single, trusted news digest to read for the day and limit yourself to only consuming news in this format.
• A related tip that is used in lifestyle management is to schedule “worry time” as a way of achieving a sense of control and limiting the impact of worries on activities important for good mental health, including sleep, meaningful discussion with others, and exercise.

“Threat Response”
• Involves the brain’s negative affect circuits when activated by threats (real or perceived) in your environment
• Being hyper-attuned to these threats
• Activates automatic reactions that put the brain and body into “alarm mode” and which may be hard to switch off
• These automatic reactions may be experienced as physical sensations such as shakiness and being startled
• Disorders that relate to heightened reactivity of the brain’s threat networks - such as anxious depression, PTSD – may be at heightened risk of being exacerbated by any aspects of the COVID-19 related situation that trigger their trauma reaction.
• A common sense tip extrapolating from a large body of work on trauma-related therapy is, in the short term, to avoid stimuli that are activating - these may be media sources, particular friends/family who are panicking. Over time, gradual exposure to necessary stimuli could be attempted, and this is where tele-mental health could be of support.
From a population and workplace perspective, some interventions have been assessed as part of responses to other disasters; for example, following tsunami events. Some of the findings are relevant to considering options for immediate intervention. For example, there is evidence that having daily workplace “de-briefings” to discuss the impact of the situation can actually promote rather than help with anxiety. Some common-sense alternative approaches – such as a focus on some normal routines to create stability and a sense of control - would make sense in regard to principles of brain function.

“Emotional Numbness/Anhedonia”

- Involves the brain’s positive affect circuit, also known as the reward circuit
- Sometimes unable to take pleasure in activities that usually bring you joy and give you purpose
- May take more effort to respond to positive interactions and feel like you are “going through the motions”
- A very large body of work shows that, from infancy onward, humans need social interaction and multiple sources of human feedback for their brain development to flourish and to feel a sense of positivity and that they are thriving.
- Anhedonia can involve a “vicious cycle”; when the reward network is underactive the individual may retreat from interaction and not feel interested in their usual activities or motivated to pursue them. As a result, their sources of stimulation are also limited, and the anhedonia worsens. In the current situation surrounding COVID-19, we are necessarily physically isolated, and in a situation that in many ways may mimic anhedonia. Apart from those in our immediate home environment, we have a limited channel of feedback (such as via a screen and or a phone. In many cases, this channel is further constricted by reducing visual information to a screen and decreasing subtle audio information, such as tonality and frequency, that normally allows more nuanced communication.). We lack all of the nonverbal cues that are so important to connection, and other vital sources of human feedback – touch, smell, and the nuances of body gestures.
- In this situation we would anticipate anhedonic depression and anxiety will be exacerbated, and this will be a risk factor for suicide (given that anhedonia is already one of the biggest contributors to suicide
risk). Anhedonia is also a feature of other disorders that impact the brain’s reward network, such as Parkinson’s disease and psychotic disorders.

- We anticipate that otherwise healthy individuals will experience periods of anhedonia as a result of the physical isolation and the limited channels of communication. Recognizing this will likely be important in identifying lifestyle changes that can help mitigate the impact.

- Another common-sense tip: utilizing other sources of stimulation to engage the brain’s reward network could help - finding pleasant smells for the home, playing favorite music, surrounding oneself with positive images, finding ways to connect that could bring joy rather than only focus on the anxiety of the situation.

“In anxious avoidance”

- Involves the brain’s salience circuit
- Situations that cause anxiety can in turn have a physical expression such as tightness in the gut, sweaty palms or palpitations. These physical expressions can cause a person to further avoid the situation that triggers stress.
- May feel the need to remove yourself from stressful stimulation and to reorient attention
- Can impact satisfaction with life
- As technology advances, some people may favor low-pressure forms of communication, such as choosing text over phone calls. During this time, such avoidance could constrict vital human connection even further.

“Inattention”

- Involves the brain’s attention circuit
- Difficulty concentrating and staying focused
- May feel worn out by the need to force yourself to concentrate on a task
- Basic functions at work and home may be hard to complete
- As in-person meetings are swapped out for videoconferencing, attention networks are even further strained as many extraneous stimuli (such as the faces of other participants) are all presented at once.
- A common-sense tip: break down your tasks so you can do them one step at a time. Decide what one you most want to achieve in the next hour or in that day. Write it down on its own piece of paper. Expand the list only once that task or goal is done.
“Cognitive Fog”

- Involves the brain’s cognitive control circuit
- Brain may feel foggy, rather than sharp
- Difficulty in executive thinking that relies on making decisions and inhibiting unwanted thoughts and reactions
- Can make planning ahead harder.
- As many individuals are being faced with unexpected changes in plans, such as changes in work and family structure, planning and adapting to change can become even more difficult.
- A common-sense context: With the rapid changes we are experiencing our brains are also going through rapid learning and plasticity (a kind of sudden ‘brain marathon’). We are pushing our capacity for flexible thinking to the maximum. It is understandable our brain will get tired – just like we would feel tired if we went from minimal exercise to trying a marathon. So, it’s OK to give yourself permission for your brain to rest and catch up.

It’s tremendously gratifying to share this research with people who may benefit directly from it especially during a time when extra strain is placed on the mental health of people all over the world. Understanding these biotypes will help us move the mental health conversation from awareness to action; because when people can identify their own personal signs of stress, it can empower them to take meaningful action in their everyday lives.

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For more information on our work, please visit http://med.stanford.edu/pmhw

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