



**FAMILIES EMPOWERED AND SUPPORTING  
TREATMENT OF EATING DISORDERS**  
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# PUZZLING SYMPTOMS:

## EATING DISORDERS AND THE BRAIN

A FAMILY GUIDE TO THE NEUROBIOLOGY  
OF EATING DISORDERS

F.E.A.S.T. FAMILY GUIDE SERIES

FALL 2012



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## **I DON'T WANT TO TELL ANYONE THAT MY DAUGHTER HAS SOMETHING WRONG WITH HER BRAIN. I'M AFRAID SHE'LL BE STIGMATIZED AND FEEL BAD ABOUT HERSELF.**

This is unfortunately true: there is stigma around psychiatric illnesses, including eating disorders. The stigma is based on ideas that are mostly unfounded: for example that brain problems can't be fixed, that patients don't recover, or that they are permanently "broken" or strange. In any case, hiding from the truth may lead to poor care decisions and lower the chance of full recovery. It is important for parents to know that mental illness is quite common, and a new era of thinking about the brain and psychiatric disorders is under way. Like breast cancer, eating disorders need not be something that is whispered about and the end of stigma begins with how each of us addresses it.

### **HOW DOES NEUROSCIENCE HELP WITH TREATMENT?**

The most important lesson from neuroscience is that eating disorders are treatable. Second, knowing that the brain is operating differently in eating disorder patients can help families respond with less frustration: it can help to understand that this is not a set of choices or lack of motivation to change. No one, including the patient, is at fault. Finally, parents and families need to focus on helping the patient regain their health through normal eating, providing a warm and supportive family environment, and working with a clinical team with the most recent training and expertise.

In addition, new advances in understanding eating disorders are leading to new therapies – psychological and medical – that target the specific pathways that have gone awry for the patient. For example, treatment may help people learn to use constructive coping strategies for traits such as anxiety or perfectionism, rather than engage in unhealthy or destructive behaviors.

An eating disorder diagnosis is an opportunity to begin treatment that can free a loved one to go on with their life. Modern neuroscience has a great deal to offer families doing what they do best: supporting a loved one!

## THOSE WHO RECOVER FROM EATING DISORDERS ARE ALSO OFTEN QUITE SUCCESSFUL IN THEIR CAREERS, RELATIONSHIPS, AND INTERESTS.

The conclusion? Those with anorexia nervosa had brains that experience altered reward from food. This helps us understand the struggle with decision-making around food choices. Without the positive reward that comes from eating, it is possible that patients have a greater ability to ignore hunger cues, yet still display great interest in food and cooking because at some level they know they are hungry.

The insula, a part of the brain that processes taste, is also important to keeping us aware of our body, and any changes going on. If the insula is not giving us those messages, it could help explain why patients “feel fine” despite being quite ill, and may contribute to the distorted sense of body shape and size so common to these patients.

### IT'S NOT JUST THE EATING, OUR SON WON'T STOP EXERCISING

Although patients give many reasons for “needing” to exercise, some of this drive may also be explained neurologically. Studies with rats have shown that the drive to exercise even when exhausted and underfed can be so strong that animals might run until they die. Dopamine, a chemical in the brain (neurotransmitter), may play a role. Leptin, a newly discovered hormone that affects the brain's hypothalamus, is believed to contribute to hyperactivity in starving mice.

### SHE THINKS WE'RE GOING TO MAKE HER FAT.

Eating disorders are perplexing and difficult to understand, for both the family and the patient. Fears, sometimes irrational ones, can take hold and be impossible to argue away. Some of these fears have to do with what others are doing and saying. Eating disorder patients are often on high alert to criticism and struggle to take in compassion while ill: as their attention is very focused on the immediate concerns of the eating disorder. Patients often report feeling disconnected and distrustful of family and friends. Some of these symptoms may be worsened by altered brain function and malnourishment. Repairing relationships with family is an important aspect of treatment.

## PUZZLING SYMPTOMS: EATING DISORDERS AND THE BRAIN

### OUR LOVED ONE HAS AN EATING DISORDER. WHAT DOES THIS HAVE TO DO WITH THE BRAIN?

Although people with eating disorders struggle to eat normally, this is only a part of the problem. This is a disorder that affects thinking, mood, behavior, and relationships. We now believe that part of the problem has to do with how our brains process information about the environment and the body.

### CAN THIS PROBLEM BE FIXED?

Yes. With appropriate professional and family assistance these processing problems can be addressed and improved – even normalized. The brain is remarkably good at learning and developing in response to a supportive environment, skills-training, psychological therapy, and good physical health. Moreover, many of the traits that make a person vulnerable to an eating disorder are very useful and helpful to that person in recovery and maintaining health.

### WHAT IS WRONG WITH THE BRAIN WHEN SOMEONE HAS AN EATING DISORDER?

Our knowledge is evolving as we learn more about brain function and development. Often, a young person has certain traits since early childhood that had nothing to do with food or eating that are early signs. Looking back, most families will remember that the patient had one or more of the following traits even as a young child: anxious, sensitive, obsessive, perfectionist, impulsive, difficult to soothe. These personality traits may indicate differences in brain function that put young people at special risk of developing eating disorders.

There may also be differences in how certain young people's brains do not receive enough nourishment. Unfortunately, for these individuals if they stop eating enough for their growth needs or activity level, their restricted eating can lead to dramatic changes in the brain. Once started, it can be difficult for the young person to get “back to normal” without help. Because of the unique way the person's brain and body responds to limited nutrition, the longer they are malnourished, the harder it becomes to eat normally again. For some young people a cycle of delaying meals, over-eating, and purging also sets in.

Researchers do not yet have all the answers, but it is believed that eating disorders involve disturbances in the pathways of the brain. There may be several ways for things to malfunction, but we know that pathways involved are those that manage mood, emotions, reward, memory, fear, and attention.

Adolescence is a time of dramatic physical, emotional, social change, and growth towards becoming independent. For those who have problems with rigid thinking or impulse control, this time of transition is particularly challenging. This can make adolescence a period of vulnerability where normal brain development can be disrupted. This vulnerability makes it all the more urgent that eating disorder behaviors and thinking be addressed as early as possible to prevent changes to the brain that are hard to reverse and that can have life-long effects on the individual's thinking, feelings, and behavior.

### HOW DO WE KNOW ALL THIS?

Recent work using brain imaging, cognitive testing, and studies of the brain nerve cell functioning has harnessed new technology to begin to identify some of the key brain mechanisms, pathways and chemical signals (neurotransmitters) underlying eating disorders. While individual pathways to the development of eating disorder are many and may vary from person to person, the key similarities in thoughts and behavior seen in eating disorder patients seem to indicate similar brain disturbances.

### WHY DOESN'T MY CHILD UNDERSTAND THAT THIS IS UNHEALTHY?

It is so important for families to know that their loved one is in an altered state even when they may seem otherwise quite bright and rational. The brain is a complex network of systems and one system can be malfunctioning without affecting the others. People with eating disorders often manage to get excellent grades in school and perform well in jobs. It is not uncommon for patients to argue forcefully about their reasons for their behaviors, even believing they do not need to eat, gain weight, or engage in treatment. This lack of insight often gets better with treatment.

**PATHWAYS INVOLVED ARE THOSE THAT MANAGE MOOD, EMOTIONS, REWARD, MEMORY, FEAR, AND ATTENTION.**

### OUR DAUGHTER DOES SO WELL IN SCHOOL: IT SEEMS TO BE THE ONLY THING THAT MATTERS TO HER

For those with eating disorders, it is common to have traits that are obsessive. This can be good, as when it helps with schoolwork or other detailed work, or bad, as when it limits one's activities or makes normal life unpleasant. Other common traits are a strong sense of right and wrong, following rules, caring about others, and worry about the future. Because these qualities are often highly valued in society those who recover from eating disorders are also often quite successful in their careers, relationships, and interests.

### OUR SON SAYS HE'S NOT HUNGRY, BUT HE MUST BE. WHAT'S GOING ON?

For healthy people, appetite seems to work in a very simple way: eat when you're hungry, stop when you're full. In fact, appetite is complex and involves not only the senses but also emotions, hormones and levels of nutrients in the bloodstream – all coordinated by the brain which has other competing functions. The person's history with food also matters, as does the flavor and availability of food.

People with eating disorders may also have a disturbance in appetite. Hunger feels different, fullness feels different, and eating less than needed actually can feel calming, and relieve anxious and depressed feelings, for young people with this predisposition.

To research this, scientists have studied the brain response to sweet drinks, comparing people with anorexia nervosa with others. In both groups, the tongue tasted the sweetness, but as the signal passed to the primary taste center in the anterior insula of the brain, individuals with anorexia nervosa processed the taste differently. This even occurred when they looked at pictures of food while having their brains imaged. Something was different in the anorexia nervosa patients, and between current patients and recovered patients.

## IN EATING DISORDERS “FOOD IS MEDICINE.”

## ...THERE IS NO REASON TO REFER TO EATING DISORDERS AS FEMALE PROBLEMS.

During adolescence, male and female children develop differently. Girls and boys have different changes in the hormones in their body and these affect metabolism and body shape. For example, estrogen affects chemicals in the brain, like serotonin, that have a strong influence on appetite and emotions. Puberty brings dramatic changes in certain areas in parts of the brain that may contribute to excessive worry and increased perfectionism. Changes in the body also bring changed interactions with the environment including a pressure to diet for girls and to appear athletic for boys. Romantic interests and social pressures bring stresses to the brain as well.

Treatment for both boys and girls involves restoring the brain's functions, providing a supportive environment, and good mental health care.

### HOW ABOUT MEDICATIONS?

In eating disorders “food is medicine.” So far, there are no psychiatric medication that cure eating disorders, but several may help with symptoms, or with the distress at certain stages of treatment. In addition, because many people with eating disorders also have other disorders they may be treated with psychiatric medications.

### WE RAISED OUR KIDS IN THE SAME WAY: WHY DID ONE GET AN EATING DISORDER AND THE OTHER DID NOT?

All individuals, including identical twins, have unique brain development. Starting in the womb, brains are affected by hormones, nutrition, and experience. Even virus exposure may play a role. We know, for example, that being born in certain seasons or with an opposite sex twin can affect the risk of an eating disorder. While two people may be born with an equal disposition for an eating disorder, many factors may determine whether the disorder occurs or what form it takes. We also know that each person is born with tendencies for personality traits, like perfectionism or anxiousness, that last their whole lives and seem to be associated with eating disorder risk. Two siblings might react to the same situation – a family crisis, for example – in very different ways, which tells us something about their lifelong traits. Two siblings may become anxious about an event, but one calms down when the danger is gone (state), and the other might remain anxious regardless of the situation (trait).

### WHY DO PATIENTS BELIEVE THEY ARE OVERWEIGHT WHEN THEY ARE NOT?

The sense of feeling “fat” is perhaps the most puzzling eating disorder symptom, and remains poorly understood. While sociocultural influences are thought to play a role, these body image symptoms are so persistent – even in very underweight individuals with anorexia nervosa – this raises the question of whether there is a biological cause. How big we feel not only depends on our physical senses but also on our beliefs, memories and emotions. It is possible that this information may not be being processed accurately by the brain. In fact, some recent imaging work tends to show altered function of the parietal, and related regions of the brain, which are known to regulate body perception.

Recent work on how eating disorder patients sense temperature and their own heartbeat also indicate problems in self-perception of the body that may play a role.

Still, relatively little research has investigated possible biological contributions to body image in those with ED, so this remains an area with more questions than answers.

### HOW DO YOU FIX THE BRAIN PROBLEMS IN EATING DISORDERS?

The brain is constantly learning and changing. Restoring healthy eating and weight, along with psychotherapy, skills-building, and a supportive environment, can help eating disorder symptoms improve or go away.

While many underlying traits present since childhood, such as perfectionism or anxiety, may still exist after recovery, they are often manageable, or respond to specific psychotherapy or drug treatments.

In some cases, especially in individuals with bulimia nervosa, medication can assist in recovery. The good news is that the majority of eating disorder patients, even quite severe cases, can recover and go on to lead a healthy, productive life. The earlier the intervention, the higher the chance of success, but there is **always** hope for successful recovery.

## **THE EARLIER THE INTERVENTION, THE HIGHER THE CHANCE OF SUCCESS, BUT THERE IS ALWAYS HOPE FOR SUCCESSFUL RECOVERY.**

### **THERE ARE MORE THAN ONE KIND OF EATING DISORDER. ARE THERE DIFFERENT BRAIN PROBLEMS INVOLVED?**

This is a question that is currently under debate. We know there is a relationship between the different eating disorders because of the high rates of people who “cross over” to other eating disorders over time. While it is likely that similar regions of the brain are involved in all eating disorders, it is also likely that different mechanisms and pathways are involved. Research is still in the early stages of understanding the connections among the different disorders. At this time, we know more about changes in the brain in anorexia nervosa than the other eating disorders.

### **WHAT PARTS OF THE BRAIN ARE INVOLVED?**

There are two pathways of particular interest, especially in anorexia nervosa. These are the limbic pathway, and the cognitive pathway. Both affect appetite and emotion and thinking. The limbic pathway includes several areas of the brain including the amygdala, insula, ventral striatum, and ventral regions of the anterior cingulate cortex (ACC) and orbital frontal cortex (OFC); these areas seem to help people see what is important and rewarding, and then how to respond.

The cognitive pathway is involved with deciding what to pay attention to, how to plan, what to avoid, and how to self-control. The parts of the brain in this circuit pathway are the hippocampus, dorsal regions of the accumbens (ACC,) the dorsolateral prefrontal cortex (DLPFC), and parietal cortex. For example, brain imaging studies have shown that people who had restricting-type anorexia nervosa may have a different balance between these pathways, so that they tend to worry about planning and self-control and long-term consequences, making it difficult to enjoy immediate rewards.

### **DOES FOOD PLAY A ROLE?**

We know that starvation and weight loss have powerful effects on the body and the brain. Malnutrition impacts on the brain’s capacity to think, manage emotions and process information from its environment. Starvation often exaggerates an individual’s personality traits and ways of thinking. Malnutrition may lead to changes in brain development even after they have restored normal eating and weight. We also know that the brain responds to, and has an effect on, hormones and other body systems that are undernourished. Food certainly plays a major role; the most urgent task of early recovery and maintenance is restoring the patient’s normal weight with adequate daily nutrition. An undernourished individual’s brain cannot recover.

### **DOES DIETING CAUSE EATING DISORDERS?**

It is perhaps more accurate to say that a person’s response to a diet can reveal an eating disorder. Most children and adolescents can diet and then go back to their normal eating behaviors. When two young women decide to lose a few pounds together, and one gives up after a week and the other not only continues but becomes underweight and obsessive, it is likely that the difference between them is a difference in how their brains respond to inadequate nourishment. The one who ends the diet is responding to the biological need to eat normally. Neuroimaging studies indicate that anorexia nervosa patients are able to ignore urgent signals from the brain to eat that most people cannot resist. There is also evidence that anorexia nervosa patients may feel less reward from eating and feel some relief from anxiety when under-eating.

## **AN UNDERNOURISHED INDIVIDUAL’S BRAIN CANNOT RECOVER.**

### **MY SON IS ASHAMED TO HAVE AN EATING DISORDER BECAUSE EVERYTHING HE HEARS OR READS IS ABOUT GIRLS.**

Rates of eating disorders are higher in girls than boys, especially for anorexia nervosa and bulimia nervosa. This does not mean, however, that the diseases are less severe in male patients. Just as with other illnesses where males are more likely to be affected, like heart disease and autism, there is no reason to refer to eating disorders as female problems.