# The Nature and Causes of Anxiety and Panic

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#### 1.0 Introduction

Fear is probably the most basic of all emotions. Not only is it experienced by all humans, but fear responses have been found in all species of animal right down to the sea slug. Experiences of fear vary tremendously in their severity from mild worry to anxiety to extreme terror and panic. The experience of fear can also vary in duration from a brief, almost fleeting flash, to a constant, all day affair. While anxiety and panic, by nature, are unpleasant, they are not in the least bit dangerous. It is this last point which forms the basis of this hand-out, namely to increase your knowledge about anxiety and panic. As you learn more about the nature and physiology of anxiety and panic, you may begin to realize that (a) many of the feelings and symptoms which you now experience are the normal result of your alarm system being needlessly triggered and (b) that these feelings are not harmful or dangerous.

# 2.0 Definitions of Anxiety and Panic

Although many definitions of anxiety have appeared over the years, there is a core theme that emerges in these definitions. This theme involves the anticipation of danger or threat. For this reason we define **anxiety** as a normal innate emotional alarm response to the anticipation of danger or threat. There are several keyterms in this definition that deserve further discussion. First note the use of the term *innate*. That simply means that anxiety, like other emotional responses is a natural part of our biological make-up. We do not have to learn now to become anxious. Rather, it is automatically triggered under certain conditions - namely when one perceives danger coming down the pike. Note the use of the term *normal*. Unfortunately, many people believe that anxiety is bad, dangerous, or abnormal. On the contrary, without the help of anxiety, humans would not have been able to survive! The use of the term alarm highlights the important protective function of anxiety. More about this important feature later!

What about panic? **Panic** is similar to anxiety in many respects. We define panic as a normal innate emotional alarm response to the perception of **immediate danger** or threat. The key distinction here is that unlike anxiety, panic is the normal protective response when the danger is more immediate. For instance, while many of us might respond with anxiety to the news that our job was being cut, having your air suddenly and unexpectedly cut oft while scuba diving at 200 feet is enough to trigger panic in even the most well trained diver. As in the case of anxiety, many people falsely believe that panic is dangerous or harmful On the contrary, panic is our normal protective response in times of immediate danger.

# 3.0 Function of Anxiety and Panic

Everyone has experienced anxiety or panic at some time. Common examples include the feelings upon entering a classroom just before an exam, or the feelings one gets when one awakes in the middle of the night to sounds of a prowler in the house. So what purpose do these feelings of anxiety and panic have for us? Protection! Anxiety and panic function as a protective alarm system to aid in coping with potential danger and threat. It is not surprising that Mother Nature in her wisdom provided us with a built-in alarm system for responding to danger. Our alarm system has two basic modes - ANXIETY and PANIC. Both modes are designed to help us respond to danger. Mother Nature was very wise in realizing that we needed different alarm responses depending on whether the danger was immediate or delayed. As already mentioned, the anxiety alarm gets triggered when we perceive future danger or threat. In essence the anxiety alarm functions as a readiness alarm. It warns us that some danger or threat is coming. That's one of the major reasons why it is possible to remain in a state of high anxiety for an entire day or more. Think of anxiety as an emotion that is telling you "you're not in trouble yet, but there is trouble coming down the road and you better be ready".

Panic, on the other hand, is our escape alarm. It is a more intense and shorter-acting emotional response to assist us in coping with immediate danger. While true panic usually lasts only a couple of minutes or less, it gives us a major jolt designed to prepare us to quickly flee the danger. Scientists sometimes refer to the panic alarm as the fight-flight response. It is so named because all of its effects are aimed toward either fighting or fleeing the danger. Thus, the primary function of anxiety and panic is to protect. Back in the cave people days, it was vital that when faced with danger, an automatic response would take over causing us to take immediate action (attack or run). Even in today's hectic world this is a necessary mechanism. Just imagine you were crossing a street when suddenly a car sped toward you blasting its horn. If you experienced absolutely no anxiety, you would be killed. However, more probably, your panic alarm would be triggered and you would run out of the way to safety. The moral of this story is a simple one — the purpose of anxiety and panic is to protect, not to harm. It would be totally ridiculous for nature to develop a mechanism whose purpose is to protect and yet, in doing so, causes harm.

A number of unpleasant physical sensations occur when our panic alarm is triggered. These include sensations such as dizziness, light-headedness, sweating, and breathlessness. When we experience the intense sensations of panic in a situation that would cause panic for most people (for instance, being in a bank in the middle of a robbery), we understand it and do not worry that something is seriously wrong with us. However,

when these same sensations appear out of the blue in a situation where we would not expect them (e.g., watching TV) it is easy to become frightened by these feelings and to worry that there must be something seriously wrong with us. Some of the common fears about these sensations include concerns about heart problems, strokes, going crazy, losing complete control and even concerns about dying. Understandably, these concerns "feed" the fear and can lead to the development of panic disorder.

# 4.0 What Happens When our Alarm System is Triggered?

Anxiety and panic manifest themselves through three separate systems working in close connection with each other. The three systems are: the mental or cognitive system; which includes the actual emotions/feelings of nervousness, anxiety and panic and also includes thoughts such as there is something wrong"; the physical system which includes all the physical symptoms such as dizziness, sweating, palpitations, chest pain, and breathlessness; and the behavioral system which includes the common urge to escape or avoid. In panic, the physical system becomes the most important because it is these symptoms which are most easily mistaken for some serious threat.

Each of the three systems of the alarm response share a common property. They each in their own way function to prepare us for immediate protective action. Let us turn to a more complete description of what happens in each of the three systems when our alarm system is triggered. As you become more knowledgeable about how our alarm system functions, you may find that your fear of anxiety and panic significantly diminishes.

#### 4.1 The Physical System

#### 4.1.1 Nervous and Chemical Effects

When some sort of danger is perceived or anticipated, the brain sends messages to a section of your nerves called the autonomic nervous system. This autonomic nervous system has two subsections or branches called the sympathetic nervous system and the parasympathetic nervous system. It is these two branches of the nervous system which are directly involved in controlling the body's energy levels and preparation for action Very simply put, the sympathetic nervous system is the fight/flight system which releases energy and gets the body primed for action while the parasympathetic nervous system is the restoring system which returns the body to a normal state.

One important point is that the sympathetic nervous system tends to be largely an all or none system. That is,

when it is activated, all of its parts respond. In other words, either all symptoms are experienced or no symptoms are experienced; it is rare for changes to occur in one part of the body alone. This may explain why-most panic attacks involve many symptoms and not just one or two.

One of the major effects of the sympathetic nervous system is that it releases two chemicals called adrenaline and noradrenaline from the adrenal glands of the kidneys. These chemicals, in turn, are used as messengers by the sympathetic nervous system to continue activity. However, it is very important to note that sympathetic nervous system activity is stopped in two ways. First, the chemical messengers adrenaline and noradrenaline are eventually destroyed by other chemicals in the body. Second, the parasympathetic nervous system (which generally has opposing effects to the sympathetic nervous system) becomes activated and restores a relaxed feeling. It is very important to realize that eventually the body will "have enough" of the response and will activate parasympathetic nervous system to restore a relaxed feeling. In other words, anxiety cannot continue forever, nor spiral to ever increasing and possibly damaging levels. The parasympathetic nervous system is a built in protector which stops the sympathetic nervous system from getting carried away. Another important point is that the chemical messengers, adrenaline and noradrenaline take some time to be destroyed. Thus, even after the danger has passed and your sympathetic nervous system has stopped responding, you are likely to feel -keyed up or apprehensive for some time because the chemicals are still floating around in your system. You must remind vourself that this is perfectly natural and harmless. In fact this is an adaptive function because in the wild danger often has a habit of returning and it is useful for the organism to be prepared to activate the fight/ flight response.

#### 4.1.2 Cardiovascular Effects

Activity in the sympathetic nervous system produces an increase in heart rate and in the strength (called stroke volume) of the heartbeat. This is vital to preparation for activity because it helps speed up blood flow, thus improving delivery of oxygen to the tissues and removal of waste products from the tissues. In addition to increased activity in the heart, there is also a change in the blood flow. Basically, blood is redirected away from the places where it is not needed (by a constriction of the blood vessels). For example, blood is taken away from the skin, fingers and toes. This is useful because if the organism is attacked and cut in some way, it is less likely to bleed to death. Hence, during anxiety the 'skin looks pale and feels cold and fingers and toes become cold and sometimes experience numbness and tingling. In addition, the blood is moved to the large muscles

such as the thighs and biceps which helps the body prepare for action.

#### 4.1.3 Respiratory Effects

The fight/flight response is associated with an increase in the speed and depth of breathing. This has obvious importance for the defense of the organism since the tissues need to get more oxygen in order to prepare for action. The feelings produced by this increase in breathing, however, can include breathlessness, choking or smothering feelings, and even pains or tightness in the chest. Importantly, a side effect of increased breathing, especially if no actual activity occurs, is that oxygen supply to the head is actually decreased. While this is only a small amount and is not at all dangerous, it produces a collection of unpleasant (but harmless) symptoms including light-headedness, dizziness, blurred vision, confusion, unreality, and hot flushes.

#### 4.1.4 Sweat Gland Effects

Activation of the fight/flight response produces an increase in sweating. This has important adaptive functions such as making the skin more slippery so that it is harder for a predator to grab, and cooling the body to stop it from overheating.

#### 4.1.5 Other Physical Effects

A number of other effects are produced by activation of the sympathetic nervous system, none of which are in any way harmful. For example, the pupils widen to let in more light which may result in blurred vision, spots in front of the eyes, etc. Mother nature also decided that digesting a steak while in a potentially dangerous situation is not a wise allocation of resources. Therefore, there is a decrease in salivation, resulting in a dry mouth. There is decreased activity in the digestive system which often produces nausea, a heavy feeling in the stomach and even constipation. Finally, many of the muscle groups tense up in preparation for fight or flight and this results in subjective feelings of tension, sometimes extending to actual aches and pains as well as trembling and shaking.

Overall, the fight/flight response results in a general activation of the whole bodily metabolism. Thus, one often feels hot and flushed and because this process takes a lot of energy, afterwards one generally feels tired, drained, and washed out.

#### 4.2 The Behavioral System

As mentioned before, the fight/flight response prepares the body for action- either to attack or to run. Thus, it is no surprise that the overwhelming urges associated with this response are those of aggression and a desire to escape wherever you are. When this is not possible due to social constraints, the urges will often be shown through such behaviors as foot tapping, pacing or snapping at people. Overall, the feelings produced are those of being trapped and needing to escape.

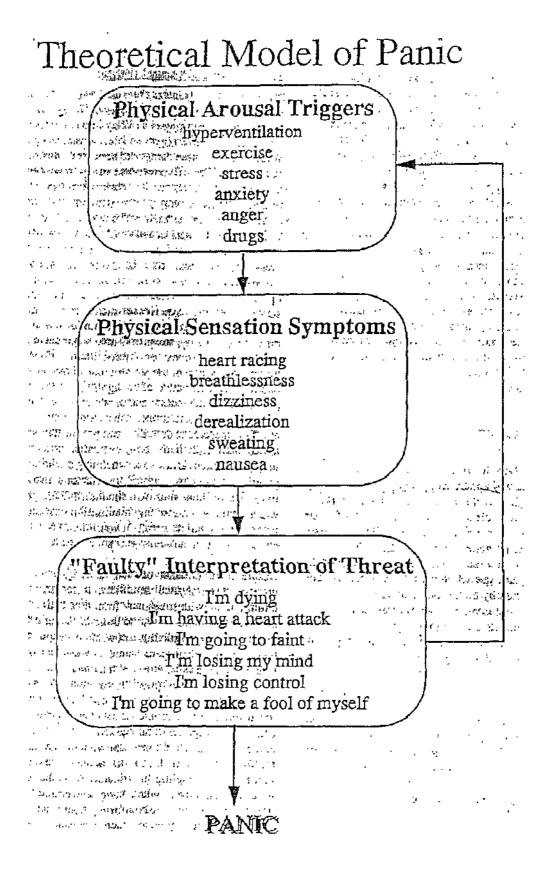
#### 4.3 The Mental System

The number one effect of the fight/flight response is to alert the organism to the possible existence of danger. Thus, one of the major effects is an immediate and automatic shift in attention to search the surroundings for potential threat. In other words it is very difficult to concentrate on daily tasks when one is anxious. Therefore, people who are anxious often complain that they are easily distracted from daily chores, that they cannot concentrate and that they have trouble with their memory. This is a normal and important part of the fight/flight response since its purpose is to stop you from attending to your ongoing chores and to permit you to scan your surroundings for possible danger. Sometimes, an obvious threat cannot be found. Unfortunately, most humans cannot accept having no explanation for something. Therefore, in many cases, when people cannot find an explanation for their sensations, they turn their search upon themselves. In other words "if nothing out there is making me feel anxious, there must be something wrong with me." In this case, the brain invents an explanation such as "I must be dying, losing control, or going crazy". As we have now seen' nothing could be further from the truth since the purpose of the fight/flight response is to protect not to harm. Nevertheless, these are understandable thoughts.

#### 5.0 Panic Attacks

Up until now, we have looked at the features and components of normal anxiety and panic. However, you may be wondering, how this applies to the panic attacks experienced by those suffering from panic disorder? After all, why should our alarm system be activated during panic attacks when there is apparently no real danger? Following extensive research, it appears that panic attacks are brought on by unexpected physical sensations that are incorrectly processed by the person as signaling immediate danger or threat. The two central factors present during panic attacks are (a) the presence of physical sensations and (b) the appraisal or interpretation of these sensations as signaling immediate danger or threat. The Figure on the next page further illustrates the processes operating in panic attacks.

Let's take a closer look at the factors leading up to a panic attack based on this cognitive-physiological model. Although many panic attacks sometimes appear to come on "out of the blue," even these panics have specific triggers. Becoming more aware of the nature of these triggers is an important first step in learning to overcome panic.



#### 5.1 Physical Arousal Triggers

There are a host of factors that can bring on the physical sensations of the fight/flight response. It may be useful to think about these triggers as falling into two broad categories - stress-related triggers, and non-stress triggers. Within each of these categories there are a number of specific triggers. We will cover some of the more common triggers in each category. Let's start with stress-related triggers. Stress may be defined as the physical and mental reactions to demands. Demands include anything in a person's life that requires time or effort (mental or physical). Stress can vary greatly with respect to the nature of the stressor/demand, the intensity of the stress, and its duration. Traumatic life events such as the death of a loved one or the break-up of a marriage are common sources of stress. Stress may also result from the chronic day to day Hassles and worries related to work, school, family, or financial pressures. Stress does not always come from negative sources. Positive experiences such as getting married, having a child or getting a job promotion may also produce stress. Finally, stress may also be present as a result of debilitating phobias, or physical illness. Regardless of the specific nature of the stressor, one of the consequences of stress is production of adrenaline and other chemicals which can trigger physical sensations such as heart racing, dizziness, etc. This increased adrenaline can presumably be maintained chemically in the body even after the stressor has long gone. There is now overwhelming scientific evidence pointing to stress as a contributing factor in panic reactions. Think about your own situation and ask yourself whether you've noticed any relationship between your panic attacks and the stress in your life. Chances are that stress has played a role in your panic attacks.

Despite the importance of stress as a trigger of uncomfortable physical sensations, factors that have nothing to do with stress may from time to time trigger physical sensations similar to those of the fight/flight response. As you probably know, some people report that their first episode of panic came on when they were under little or no noticeable stress. What other factors aside from stress trigger unusual physical sensations? A number of physical factors can bring on unusual bodily sensations. For instance, some people report their first panic attack came on in response to taking certain drugs. Marijuana and caffeine have both been shown to trigger unusual bodily sensations such as heart racing (caffeine) and numbness and tingling (marijuana). A number of different medications, some of which have been used to block panic attacks, can produce uncomfortable bodily sensations. Examples of other physical factors capable of triggering unusual bodily sensations include physical illness, menstrual periods, pregnancy, allergies, inner ear disturbances, exercise, eating, and even deep

relaxation.

Recently, there has been extensive research examining the possible role of hyperventilation in causing panic attacks. Although we have known for years that many people hyperventilate in response to severe anxiety or panic, only recently have scientists' examined chronic overbreathing as a possible cause of panic. By breathing a little too fast and shallow, changes in blood chemistry occur which trigger uncomfortable physical sensations. Because this faulty breathing pattern is very slight (subtle hyperventilation), you easily become used to this level of breathing and do not notice that you are hyperventilating. Thus, when you first notice the uncomfortable physical sensations, they appear to come on "out of the blue," despite being triggered by something as basic as your own breathing patterns.

Relatively little is known about the biological and genetic factors that help trigger unusual bodily sensations. Mitral valve prolapse, a harmless abnormality of the heart, has been shown to trigger tachycardia (racing heart) and palpitations. Postural hypotension (experiencing a sudden light-headedness when changing from a seated to standing position due to low blood pressure) may also produce discomforting physical sensations. It is likely that future research will discover other biological and genetic factors that contribute to the triggering of unexpected bodily sensations. Perhaps some people have a genetically programmed "hairpin trigger" for the fight/flight response, thus making it more likely that physical sensations will be activated with little provocation.

### 5.2 <u>Ingredient Two - Faulty Appraisal of Treat</u>

You have just been exposed to some of the many ways in which uncomfortable physical sensations may be triggered. Remember from our theoretical model on the previous page that physical sensations in themselves are sufficient to bring about a panic attack. For instance, experiencing an uncomfortable or unexpected bodily sensation such as tingling or numbness in one's fingers does not automatically produce a full-blown panic attack. The second necessary ingredient for panic to occur is the faulty processing or appraisal of the bodily sensations (refer back to the third box in the "Model of Panic" figure). Physical sensations that are processed and interpreted as being of no consequence (no danger - no threat) will not lead to panic. Take for example the man who runs up a flight of stairs because he is late for a meeting at work, and notices that his heart is beating rapidly. If he interprets this change in heart rate as being a natural result of running up stairs, chances are very strong that he will not think twice about it.

On the other hand, when bodily sensations are perceived as dangerous, our alarm system is triggered which in turn leads to even more intense bodily sensations. This process can easily snowball into a full-blown panic. Keeping with the previous example, assume our stressed out executive gets to the top of the stairs and again notices the change in his heart rate. But this time, he interprets his heart rate increase as a sign of an impending heart attack. His fear that his life is in immediate danger, activates his sympathetic nervous system. This triggers more intense bodily symptoms, thus reinforcing his erroneous perception of danger, culminating in panic.

Our cognitive-physiological model of panic is so named because it asserts that panic is caused by bodily sensations (the physiological component) that are incorrectly interpreted (the cognitive component) as signaling immediate danger or threat. An important implication of this model for treatment is that panic can be effectively diminished by correcting the faulty processing of danger associated with the natural and harmless physical sensations of the fight/flight response. Put another way, once you truly believe (100%) that the physical sensations are not dangerous, the fear and panic will no longer occur and you will eventually no longer experience panic attacks. Of course, once you have had a number of panic attacks, the faulty processing of danger becomes quite automatic and it is then very difficult to consciously convince yourself during a panic attack that the bodily sensations are harmless. In this next section, some of the beliefs which contribute to the faulty perception of danger are discussed. As mentioned previously, increased awareness is an important first step in learning to control panic.

# 6.0 MYTHS AND MISINTERPRETATIONS

#### 6.1 Going Crazy

Many people, when they experience the physical symptoms of the fight/flight response, believe they are "going crazy." Within this belief, they are most likely referring to a severe mental disorder known as schizophrenia. Let us look at schizophrenia to see how likely this is.

Schizophrenia is a major disorder characterized by such severe symptoms as disjointed thoughts and speech, sometimes extending to babbling, delusions or strange beliefs (such as the belief that one is receiving messages from outer space), and hallucinations (for example, hearing or seeing people who are not there). Furthermore, schizophrenia appears to be largely a genetically based disorder, running strongly in families. Schizophrenia generally begins very gradually and not suddenly (such as during a panic attack). Additionally,

since schizophrenia runs in families, only a certain proportion of people can become schizophrenic and, in other people, no amount of stress will cause the disorder. A third important point is that people who become schizophrenic will usually show some symptoms for most of their lives. Thus, if this has not been noticed in you yet, the chances are you will not become schizophrenic. This is especially true if you are over 25 since schizophrenia generally first appears in the late teens to early 20's.

Most importantly, it has been clearly shown that people who suffer from panic attacks have no greater risk for developing schizophrenia than those who do not have panic attacks. Finally, if you have been through interviews with a psychologist or psychiatrist, then you can be fairly certain that they would have known if you were likely to become schizophrenic. You may be reassured to know that we screened for severe mental illness like schizophrenia during your eligibility interview. The fact that you were accepted into this study means that you do not have a serious mental illness.

#### 6.2 Losing Control

During a panic attack some people believe they are going to "lose control." Presumably, they mean that they will either become totally paralyzed and not be able to move, or that they will not know what they are doing and will run around wildly killing people, jumping off buildings, or yelling out obscenities and embarrassing themselves. Alternatively, they may not know what to expect but may just experience an overwhelming feeling of "impending doom."

From our earlier discussion, we now know where this feeling comes from. During anxiety the entire body is prepared for action and there is an overwhelming desire to escape. However, the fight/flight response is not aimed at hurting ourselves or other people (who are not a threat) and it will not produce paralysis. Rather, the entire response is simply aimed at getting the organism away from danger. In addition, there has never been a recorded case of someone "going wild" during a panic attack. And we all know that such a thing would have been picked up by the medial. Even though the fight/flight response makes you feel somewhat confused, unreal, and distracted, you are still able to think and function. Simply think of how often other people even notice that you are having a panic attack.

#### 6.3 Nervous Collapse

Many people are frightened about what might happen to them as a result of their symptoms, perhaps because of some belief that their nerves might become exhausted and collapse. As discussed earlier, the fight/flight response is produced chiefly through activity in the sympathetic nervous system which is counteracted by the parasympathetic nervous system. The parasympathetic nervous system is, in a sense, a safeguard to protect against the possibility that the sympathetic nervous system may become "worn out." Nerves are not like electrical wires and anxiety cannot wear out, damage or use up nerves.

#### 6.4 Heart attacks

Many people misinterpret the symptoms of the fight/flight response and believe they must be dying of a heart attack. This is probably because many people do not have enough knowledge about heart attacks. Let us look at the facts of heart disease and see how this differs from panic attacks. A heart attack (myocardial infarction is the technical term for heart attack) is a complete blockage of one of the major arteries leading to the heart. The blockage results in a lack of blood to the part of the heart muscle that is fed by that particular artery. During a hear attack, part of the heart muscle dies. Depending on which coronary artery was blocked, and the size of the damage to the heart muscle, the person may either survive the heart attack or die. In either case, the heart attack is a result of one or more coronary arteries becoming clogged. There are three well known risk factors that contribute to coronary heart disease. These are: (1) cigarette smoking, (2) high blood pressure, and (3) high blood cholesterol. Panic attacks do not cause or contribute to heart attacks.

The major symptoms of heart disease are breathlessness and chest pain. The symptoms in heart disease are generally directly related to effort. That is, the harder you exercise, the worse the symptoms. The symptoms will usually go away fairly quickly with rest. This is very different than the symptoms associated with panic attacks which often occur at rest and seem to have a mind of their own. Certainly, panic symptoms can occur during exercise or can be made worse during exercise, but they are different from the symptoms of a heart attack since they can occur equally often at rest. Of most importance, heart disease will almost always produce major electrical changes in the heart which are picked up very obviously by an EKG. In panic attacks there are no electrical changes which show up on the EKG. Thus if you have had an EKG and the doctor has given you the all clear, you can safely assume you do not have heart disease. Also, if your symptoms occur any time and not only upon exertion, this is additional evidence against a heart attack.

#### 6.5 Seizures

Some people worry that they are having a seizure during a panic attack or that their panic will set off a seizure. Both of these concerns are completely false. To understand why, these concerns about seizures are completely false it may be useful to learn about seizures. The brain is composed of billions of tiny cells called neurons which act as wires to transmit and receive messages throughout the body. One way to think of the brain is as a telephone switchboard -accepting incoming calls from one part of the country and sending them out to another part of the country. For example, when I pick up the phone and dial the number of a phone far away, the sequence of numbers that I dialed (i. e., the "signal") is sent along the phone lines ("neurons") to the main telephone switchboard (area of the brain where information is processed). The switchboard (brain) then sends a message along a different line (again, "neurons") to the phone I am calling (a part of the body), which then rings (the action that the brain wanted done).

In the normal brain, millions of signals are relayed every second in a perfectly-timed fashion. However, a small ' percentage of people have brains that are not as well organized as the rest of the population, and some of their neurons are not as efficient as they should be. As a result, their neurons send signals that are not accurate and not well-timed. Sometimes, these neurons send many of these inaccurate signals to the brain all at once, rather than in a perfectly-timed sequence. This is a seizure. There are many different types of seizures, depending on where the inefficient neurons are located. Some seizures involve involuntary muscle movements (e. g., grand mal epilepsy and "partial" seizures) while others involve only a very brief period of "staring off into space" (i.e., petit mal epilepsy, also known as "absence" seizure). In any case, a seizure always involves some period of unconsciousness so the brain can reset itself and begin functioning normally again. The length of unconsciousness typically varies from a few seconds (for petit mal seizures) to a few hours (for grand mal seizures). When the individual awakens, he or she usually has no memory of the event.

What causes people to have these "inefficient" neurons? The most common cause is genetic - some people are born with neurons that have the potential of being inefficient. Seizures may also occur as a result of damage to the brain. Most people who develop a seizure disorder have their first seizure while they are a child. In the case of the petit mal or "absence" seizure, the disorder goes away when the child reaches puberty. Unfortunately, other types of seizures do not go away on their own and must be treated with medication. These drugs have been proven to greatly reduce, and even eliminate, both the frequency and severity of seizures.

A very important fact to remember is that *a panic attack* is not a seizure. And furthermore, panic attacks in no way cause seizures. The processes that are involved in panic are quite distinct from those of seizures, and research has shown that there is absolutely no

relationship between panic attacks and seizure disorder.

One striking difference between people with seizures and those with panic can be found in their EEG readings. Even when a person with seizure disorder is not having a seizure, these neurons are producing odd, poorly-timed electrical signals which can be picked up and recorded with an EEG. People with panic disorder do not show these abnormal patterns; their EEG readings are the same as you would find in any random sample of the population.

There are also striking behavioral differences between panic attacks and seizure disorders. First, seizures involve a loss of consciousness. This is not true of panic attacks. Second, during *all* seizures the individual cannot consciously perform purposeful movement. Another behavioral difference between seizures and panic attacks is that people who are having a panic attack can purposefully and voluntarily move and control any part of the body they wish. A simple test of this during a panic attack is to make a fist and open it again. People who are having a seizure cannot do this or any other controlled activity. Again, it is logical to retain control of your muscles during panic because if you have to fight or run away you need to be able to make your arms and legs do what you want them to do.

Finally, people who have had a seizure do not remember what occurred during the seizure - they have absolutely no memory of the event. This is definitely not the case in panic. People who have experienced a panic attack vividly remember what went on during the attack. This also makes sense because if someone experiences the symptoms of panic in a dangerous situation (e.g., jaywalking across the street in New York City), it is adaptive to remember what happened in order to avoid a similar situation in the future.

#### 6.6 Suffocation

A misconception held by many that suffer from panic disorder is that suffocation might occur during a panic attack. The "suffocation myth" is quite understandable given the physical sensations that often accompany a panic attack. Feelings of breathlessness, tightness in the throat and/or jaw muscles/as well as a dry mouth (making it feel harder or more uncomfortable to swallow) are often misinterpreted as indicating that suffocation is imminent. It is important to remember that these physical feelings are a part of our natural alarm system, designed to protect us from danger. There are really very few ways in which to suffocate, none of which are related in anyway with panic attacks. This handout will explain the difference between actually suffocating and thinking that you are suffocating during a panic attack. However in order to fully understand why a panic attack will not bring about suffocation, a

brief review of the anatomy of the respiratory system as well as the basics involved in respiratory gas exchange is necessary.

#### 6.6.1 Respiratory Anatomy

The respiratory tract consists of the nasal, cavity, oral cavity, pharynx, larynx, trachea, and lung (see figure on the next page).

The nasal cavity is predominantly involved in breathing while the oral cavity serves a mixed function, being involved in eating as well as speech and respiration. These divisions rejoin behind the palate in the space called the pharynx. Food and liquids as well as air pass through the pharynx until they divide at the larynx due to a flap valve located on the larynx called the epiglottis. During swallowing the epiglottis naturally unconsciously closes in coordination contraction of the muscular walls in this region. This covers the airway and directs food or water into the esophagus and eventually the stomach. During respiration, however, the epiglottis remains open and air moves through the larynx (which contains the vocal cords to produce sound), into the trachea and eventually into the lungs.

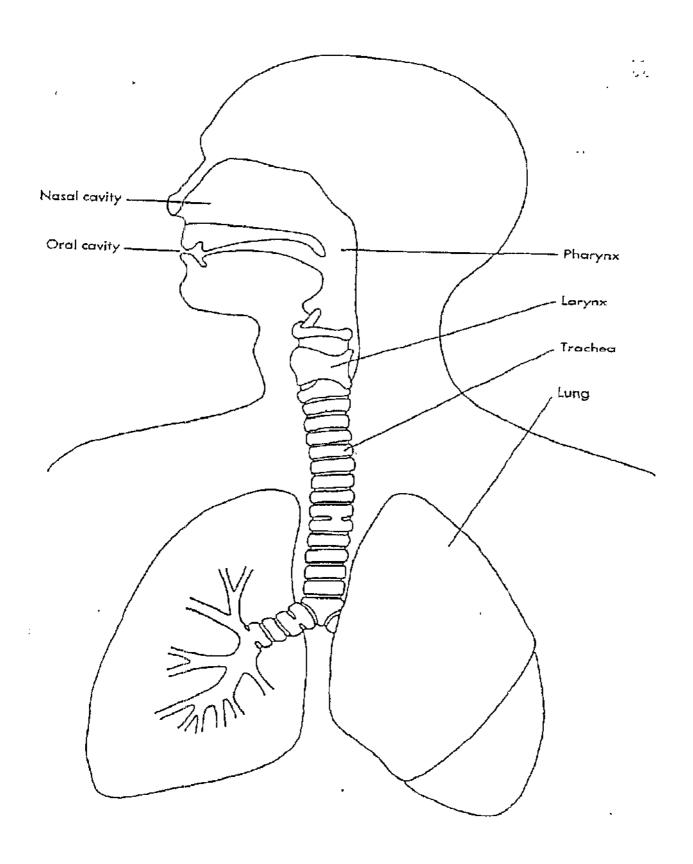
Once air has entered the lungs the exchange of oxygen and carbon dioxide can take place. This is the principal reason for respiration. Oxygen is needed throughout the body in order to supply energy at the cellular level.

Normal body metabolism results in the production of carbon dioxide which must be excreted from the body through the exhaled breath. Carbon dioxide is carried in the blood primarily in the form of bicarbonate. The transport of carbon dioxide in the body is basic to the understanding of acid base balance (pH) of the blood which will be discussed later.

Efficient control of the body's energy reactions depends on the maintenance of a specific balance between oxygen and CO<sub>2</sub>. This balance can be maintained chiefly through an appropriate rate and depth of breathing. Obviously, breathing "too much" will have the effect of increasing levels of oxygen (in the blood only) and decreasing levels of CO<sub>2</sub>, while breathing too little will have the effect of decreasing levels of oxygen and increasing levels of CO<sub>2</sub> appropriate rate of breathing, at rest, is usually around 10-14 breaths per minute.

Hyperventilation is defined as rate and depth of breathing which is too much for the body's needs at a particular point in time. Naturally, if the need for oxygen and the production of CO<sub>2</sub> both increase (such as during exercise), breathing should increase

Figure 2: Respiratory Anatomy



appropriately. Alternately, if the need for oxygen and the production of CO<sub>2</sub> both decrease (such as during relaxation), breathing should decrease appropriately.

While most of the body's mechanisms are controlled by "automatic" chemical and physical means (and breathing is no exception), breathing has an additional property of being able to be put under voluntary control. For example, it is quite easy for us to hold our breath (swimming under water) or speed up our breathing (blowing up a balloon). Therefore a number of "non-automatic" factors such as emotion, stress, or habit can cause us to increase our breathing. These factors may be especially important in people who suffer" panic attacks causing these people to show a tendency to breathe too much.

Interestingly, while most of us consider oxygen to be the determining factor in our breathing, the body actually uses CO<sub>2</sub> as its "marker" for appropriate-breathing. The most important effect of hyperventilation, then, is to produce a marked drop in CO<sub>2</sub>. This, in turn, produces a drop in the acid content of the blood leading to what is known as alkaline blood. It is these two effects - a decrease in blood CO<sub>2</sub> content and an increase in blood alkalinity which are responsible for most of the physical changes which occur during hyperventilation.

One of the most important changes produced by hyperventilation is a constriction or narrowing of certain blood vessels around the body. In particular the blood going to the brain is somewhat decreased. Coupled together with this tightening of blood vessels is the fact that the haemoglobin increases its "stickiness" for oxygen. Thus, not only does less blood reach certain areas of the body, but the oxygen earned by this blood is less likely to be released to the tissues. Paradoxically, then, while overbreathing means we are faking in more oxygen, we are actually getting less oxygen certain areas of our brain and body. This effect results in two broad categories of symptoms: 1) centrally, some symptoms are produced by the slight reduction in oxygen to certain parts of the brain (including dizziness, light-headedness, confusion, breathlessness, blurred vision, and unreality; 2) peripherally, some symptoms are produced by the slight reduction in oxygen to certain parts of the body (including an increase in heartbeat to pump more blood around, numbness and tingling in the extremities, cold clammy hands, and sometimes stiffness of muscles). It is important to remember-that the reductions in oxygen are slight and are totally harmless. It is important, too, to point out that hyperventilation (possibly through a reduction in oxygen to certain parts of the brain) can produce a feeling of breathlessness, sometimes extending to feelings of choking or smothering, so that it actually feels as if the person if not getting enough air.

Hyperventilation is also responsible for a number of overall effects. First the act of overbreathing is hard

physical work. Hence, the individual may often feel hot, flushed and sweaty. In addition, because it is hard work to overbreathe, prolonged periods will often result in tiredness and exhaustion. Third, people who overbreathe, breathe from their chest rather than their diaphragm. This means that their chest muscles, since they are not made for breathing, tend to become tired and tense. Thus, many people who overbreathe tend to engage in a habit of repeatedly sighing or yawning. These tics are actually forms of hyperventilation since whenever one yawns or sighs they are "dumping" a large quantity of CO<sub>2</sub> very quickly. Therefore, when combating the problem, it is important to become aware of habitual sighing and yawning and to try and suppress these habits.

One important point to be made about hyperventilation is that it need not necessarily be obvious to the observer. In many cases hyperventilation can be very subtle. This is especially true if the individual has been slightly overbreathing for along period of time. In this case there can be a marked drop in CO<sub>2</sub> but, due to compensation in the body, relatively little change in alkalinity. Thus, symptoms will not be produced. However, because CO<sub>2</sub> levels are kept low, the body loses it ability to cope with changes in CO<sub>2</sub> so that even a slight change in breathing (e.g., through a yawn) can be enough to suddenly trigger symptoms. This may account for the sudden nature of many panic attacks, and is one reason why many sufferers report "I don't feel as if I'm hyperventilating."

Probably the most important-point to be made about hyperventilation is that it is not dangerous. Hyperventilation is an integral part of the fight-flight response and thus its purpose is to protect the body from danger, not to be dangerous. 'The changes associated with hyperventilation are those which prepare the body for action in order to escape potential harm. Thus it is an automatic reaction for the brain to immediately expect danger and for the individual to feel the urge to escape. Consequently, it is perfectly understandable if there is no obvious danger, for the sufferer to believe the danger must be internal. Nevertheless, this is not so. It is important to remember that far from being harmful, hyperventilation is part of a natural, biological response aimed at protecting the body from harm.

# 6.6.2 Defusing The Myth

As mentioned earlier there are very few ways in which to actually suffocate, none of which are related in any way with panic attacks. In general, suffocation can occur because of an obstruction of the airway leading to the lungs, inhalation of noxious gases (taking the place of oxygen) or water (drowning), or due to overwhelming pneumonia or lung disease. There have been no reported cases of panic patients having their "throat close" during an attack, and absolutely no reason to expect this to

occur in the future. Let's discuss the actual ways in which suffocation can occur.

#### 6.6.3 Obstruction of the Airway

Obstruction of the airway can occur because of aspirated (drawn in by the suction of the breath) foreign bodies such as choking on a piece of meat at dinner. Instructors of CPR (cardio-pulmonary resuscitation) report that among people who actually suffocate, the food choked upon is the size of a pack of cigarettes! Accidental trauma to the throat such as a crushed trachea is another way to suffocate. Also, severe infection of the epiglottis (a rare disease associated with H. influenza), or a severe allergic reaction (a bee sting resulting in anaphylactic shock), or tumors of the tracheal region can result in obstruction of the airway.

The other two types of airway obstruction are emphysema and asthma, both affecting the lungs. Emphysema is a severe disease of the lungs involving the breakdown and loss of the alveolar structure. Asthma is a disease involving the constriction of the bronchial tubes and the presence of a thick mucus-like secretion in the bronchial tissue. Neither of these two chronic diseases are associated in any way with panic attacks or panic disorder.

It should be obvious that inhalation of poisonous gases or water can result in suffocation. The water or gases take the place of oxygen in the lungs. This type of situation is a true alarm, distinctly different from a panic attack (false alarm).

#### 6.6.4 Feelings of Breathlessness, Muscular Tension, Dry Mouth

Dyspnea is the subjective sensation of difficult, uncomfortable or disordered breathing. It is important to note that this is a subjective account and does not indicate that there is any respiratory dysfunction. Dyspnea is often confused with a general state of poor physical conditioning in which increased breathing is a natural response to physical exertion. This means that if you are out of shape you should expect to breathe harder than normal when walking up steps or a hill.

Hyperventilation, or "overbreathing" involves taking in too much oxygen and the excessive exhalation of carbon dioxide. This causes respiratory alkalosis which means the raising of the pH level of the blood. Hyperventilation is characterized by repetitive deep sighing respirations, a sensation of inability to expand the chest sufficiently, and a feeling of "not being able to take in enough air." You can think of this as your body's way of saying "I don't need to breathe this much, I've got plenty of oxygen!" Other sensations may include numbness of the extremities or lips, and

lightheadedness. These sensations are caused by the respiratory alkalosis. While these sensations could be interpreted as indicating a lack of air (suffocation) in actuality they indicate that "overbreathing" is occurring; too much air is being brought in and exhaled. Obviously there is no way to suffocate by overbreathing.

Muscular tension in the neck and jaw often accompany anxiety. This tension may result in the feeling that swallowing is more difficult. It is important to realize that muscular tension will not cause the airway to actually become blocked.

A decrease in salivation as a result of our natural alarm system going off may result in a dry mouth - which can make swallowing more difficult - but will not make swallowing impossible, This will not in any way affect the flow of air into the lungs.

#### 6.6.5 How to Know If You are Actually Suffocating

If you are actually suffocating (a true alarm) there are a few very noticeable signs that will occur. First, you will not be able to talk, shout, or make any appreciable noise. This is because the airway is obstructed and without airflow through the voicebox you can't make any sound. Secondly, you will become blue in the face and will pass out due to oxygen deprivation. If you can talk, or even whisper, you can be assured that air is flowing in and out of the lungs and you are not suffocating.

#### 6.6.6 Suffocation Summary

- The "suffocation myth" is quite understandable given the physical sensations that often accompany a panic attack.
- Feelings of breathlessness, tightness in the throat and or jaw muscles, as well as a dry mouth (making it feel harder or more uncomfortable to swallow) are often misinterpreted as indicating that suffocation is imminent.
- These physical feelings are a part of our natural alarm system, designed to protect us from danger.
- There are really very few ways in which to suffocate, none of which are related in any way with panic attacks.
- If you are actually suffocating you will not be able to talk, shout, or make any appreciable noise and you will become blue in the face and pass out due to oxygen deprivation.
- If you can talk, or even whisper, you can be assured that air is flowing in and out of the lungs and you are not suffocating.

#### 6.7 Fainting

Many individuals with panic disorder fear that a panic attack will lead to fainting. The "fainting myth" is quite understandable from the standpoint of the physical ' sensations which often accompany panic. Panic sensations such as dizziness, lightheadedness, derealization or unreality, and even tingling and numbness are often misinterpreted by panic sufferers to indicate they are about to faint. It seems logical that feelings of dizziness, unsteadiness, and similar physical sensations could lead to fainting because these sensations often accompany an actual faint. However, scientific evidence clearly shows that fainting does not occur during panic attacks. This section offers a description of fainting and its causes, and explains why a fainting reaction is not compatible with high anxiety or

### 6.7.1 What causes Fainting?

The vast majority of all fainting occurs due to inadequate blood flow to the brain as a result of low blood pressure or a rapid decrease in blood pressure. Blood pressure describes the degree to which the heart forces blood through the arteries and veins to supply all areas of the head and body. The heart must pump harder, i.e., with greater blood pressure, to send blood to the brain when we are standing, compared to when we are lying, because it must work against the force of gravity. Thus, it is very difficult to faint if you are sitting or lying down.

The two main causes of fainting are called vasodepressor syncope and postural hypotension.. Vasodepressor syncope occurs following physical injury (e.g., bleeding from a cut) and cues related to injury (e.g., the sight of blood, getting a shot, seeing a needle in the hospital). A very common trigger for vasodepressor syncope is getting a shot or having blood drawn. The precursors to vasodepressor syncope are a general sense of muscle weakness followed by lightheadedness. If the person is standing, the sensations will intensify over several minutes as the blood pressure drops. Once the blood pressure drops below a certain threshold, the individual experiences a loss of consciousness. The individual typically slumps to the ground whereupon adequate blood flow to the brain is immediately gained because the heart doesn't have to pump blood against the force of gravity, and consciousness returns in a matter of seconds.

# 6.7.2 Stimulus Activation of Vasodepressor Syncope

Blood or injury cues activate the protective fainting response when the brain mistakes these cues for life threatening injury. From an evolutionary perspective, it is best for the brain to err on the liberal side i.e., to create a faint when it perceives injury, rather than to react too slowly. A conservative protective mechanism might cause some people to bleed to death. In other words, it is better to faint a few times when fainting is not necessary, than to bleed to death because the faint reaction did not occur in a real emergency.

The second main cause of fainting, postural hypotension, occurs when an individual shifts from a lying or sitting position to a standing position. The act of standing leads to a decrease in blood pressure resulting in a faint. Most people have experienced this decrease in blood pressure when they stand up quickly after lying relaxed. The experience, usually lasting a few seconds, produces sensations of dizziness, spots before the eyes, or even a brief "black out". Individuals with low blood pressure, on certain medications that affect blood pressure, or with circulatory conditions that do not allow for quick adjustment of blood pressure, are at higher risk for postural hypotension.

Both vasodepressor syncope and postural hypotension are easily treatable. Persons quickly recover adequate blood pressure once lying down. They may be told to exercise their legs to help speed the recovery of blood pressure. In fact, muscle tension of any kind helps to increase blood pressure and speed recovery. A preventative treatment for fainting due to blood injury phobias is to have individuals tense their muscles to maintain higher blood pressure.

Although circulatory inadequacy accounts for the vast majority of fainting, a variety of cardiac, respiratory, and cerebral conditions can also lead to a chronic pattern of fainting episodes. If you are frequently experiencing loss of consciousness due to fainting, you should be examined by a physician.

### 6.7.3 Is Fainting Dangerous?

Fainting, like the panic alarm, is a normal, protective reaction. The fainting reaction protects the individual following physical injury. Fainting protects you in two ways. First, it decreases your blood pressure to allow the blood to quickly coagulate (clot) thereby reducing blood loss following an actual injury. Second, fainting ensures that your brain is in a position, on the ground, where it can most easily continue to receive blood, when you are experiencing low blood pressure, i.e., your heart no longer has to pump blood against the force of gravity. The most common type of fainting, vasodepressor syncope, was developed through evolutionary forces. Fainting is a common occurrence with approximately 20-25% of the population fainting at least once during their lifetime. While there is some physical risk associated with the fall during fainting, this risk is very low. It would make little sense for the evolutionary process to create a protective mechanism, fainting, that would seriously injure 20-25% of the population over their lifetimes.

There is one anxiety disorder in which fainting is common. In this disorder, called blood injury phobia, the individual's fainting reaction is highly sensitive to blood and injury cues (stimuli). In the case of blood injury phobia sufferers, the normal fainting reaction (vasodepressor syncope) which occurs following real injury, often occurs in the presence of injury related stimuli These individuals typically have an extensive history of fainting related to blood injury stimuli (e.g., after seeing blood, seeing accidents, getting shots).

# 6.7.4 Why Is Fainting incompatible with Panic Attacks?

After reading about the physiology of panic attacks and the physical processes that are necessary for fainting to occur you can quickly see that the two processes are incompatible. During a panic attack, your body's alarm is going off preparing you to escape. Among other physical effects, **the alarm reaction increases** muscle tone, heart rate, and **blood pressure**. Just the opposite physical effects occur when someone faints. **During fainting, heart rate and blood pressure drop** and muscle tone is reduced. As mentioned above, one of the treatments for fainting is to have the individual tense their muscles. In fact, a panic attack would be one of the best preventions for fainting.

#### 6.7.5 A Quick Test to Evaluate your Sensations

The next time you experience sensations or dizziness, light-headedness, unreality, etc., and believe you may be going to faint, do a simple test. Simply check your pulse. If your pulse is weak and slower than your normal resting pulse, you may be at risk for a faint. However, if your pulse is strong and rapid, you will not faint In this case, the strong pulse indicates increased blood pressure which is likely due to anxiety.

#### 6.7.6 FAINTING MYTH SUMMARY

- The "Fainting Myth" originates from the similarity between panic sensations, such as light-headedness, and fainting sensations.
- The vast majority of faints occur due to low blood pressure.
- The two main causes of fainting are vasodepressor syncope and postural hypotension.
- Fainting is protective and designed to prevent bleeding to death and to ensure the brain receives blood.
- Fainting is very common and is not dangerous.

- Blood injury phobia is a specific anxiety disorder in which fainting occurs in the context of blood and injury cues.
- Panic attacks and high anxiety can not cause a faint because they raise blood pressure even though panic sensations are similar to fainting sensations.

#### 6.8 Vomiting

Some panic sufferers are concerned that they will vomit during a panic attack. Contrary to this fear, vomiting is very unlikely to occur during an attack. A description follows of the physiological changes that occur in order to vomit, and how these changes are very different from those of a panic attack.

Vomiting is a protective reflex action in which the contents of the stomach are expelled through the mouth. Several changes occur in the body before a person vomits. First, an area in the cerebral cortex of the brain responds to chemical stimuli in the body and sends a message to another part of the brain called the medulla oblongata, or the vomiting center. The vomiting center sends messages to the stomach and diaphragm, causing them to contract. This muscular pressure and contraction leads to the ejection of the contents of the stomach through the mouth.

Several classes of stimuli are associated with vomiting. These include: (a) overindulgence in food and alcohol, (b) ingesting poison or foods that have gone "bad," (c) physical conditions such as the flu, virus, hormone disturbances (in pregnancy), internal bleeding, and disorders of the endocrine system.

Prior to vomiting, a person usually feels nauseous. In addition, they may sweat, salivate excessively, and experience a reduction in heart rate. After vomiting, the person may feel physically relieved but is usually tired and weak.

From these descriptions of vomiting, one can see that although vomiting purges the body of toxins, it is not a response that helps a person leave a dangerous situation quickly. Remember, panic prepares the body to escape a dangerous situation. For this reason, the body does all it can to make energy more available. You'll recall that the physiological changes that occur during panic include an increase in heart rate, decrease in saliva flow (dry mouth), increased blood pressure, faster breathing, tense muscles, and inhibition of unnecessary activities such as digestion. **These changes are opposite of those that occur before a person vomits.** 

# 7.0 Summary

Anxiety and panic are normal emotional responses whose primary purpose is to activate us and protect us from harm. Associated with this response are a number physical, behavioral, and mental changes. Importantly, once the danger has gone, many of these changes (especially the physical ones) can continue, almost with a mind of their own, due to learning and other longer term bodily changes. When the physical symptoms occur in the absence of an obvious explanation, people often misinterpret the normal sensations of the alarm response as indicating a serious physical or mental problem. When this happens, the sensations themselves often become threatening and lead to the development of panic disorder. Learning about the nature and function of our alarm system is the first step in overcoming panic disorder.