Bryn Mawr Rehab Hospital is a center of excellence for rehabilitation care and a pioneer and leader in the field of physical medicine and rehabilitation. Bryn Mawr Rehab Hospital offers a variety of innovative and valued programs and services for people with physical and cognitive disabilities. Services are provided in multiple settings including an acute rehabilitation hospital, as well as community-based sites.

**Our Credentials**
Bryn Mawr Rehab Hospital is a private, not-for-profit organization. We are accredited by The Joint Commission (TJC) and the Commission on Accreditation of Rehabilitation Facilities (CARF). Bryn Mawr Rehab Hospital is a member of Main Line Health.
This guide has been developed to provide general information for use by family members and friends of patients with brain injuries, and is not intended to establish a standard for the treatment and care of specific patients.

The Bryn Mawr Rehab Hospital symbol communicates the organization’s commitment to helping patients achieve the greatest possible independence after an illness or injury. The figure breaking out of the box expresses the exhilaration patients feel as they progress toward greater recovery.
I. Introduction

Each year, more than 1.5 million Americans sustain a brain injury due to accidents, sports injuries, aneurysms and other catastrophic illnesses or injuries. In fact, brain injuries are the number one cause of death and neurological disability in people under the age of 35. Although the brain weighs barely three pounds, it has an enormous job. It controls all of our physical movement and sensation as well as our abilities to think, act, feel and communicate. An injury to a person’s brain can be a devastating occurrence and one that requires a very specialized rehabilitation program.

A brain injury not only affects the life of the person who experiences it, but also the lives of the people who love and support that person. You are not alone. Bryn Mawr Rehab Hospital has been providing a specialized Brain Injury Program since 1979 to help meet the needs of brain injury survivors and their families. We have found that the more knowledge you have about this condition, the greater your ability will be to take part in your family member’s treatment and to adapt to the changes that may come over time. We will be here to support you and answer your questions as the future unfolds.

A brain injury affects not only the patient’s life, but the lives of the people who love and support that person.

You are not alone.

We are here to help.
You and your loved one are at the center of a brain injury treatment team that is inter-disciplinary in nature and focuses on the behavioral, cognitive, physical and social deficits that are frequently seen after injury. We take a comprehensive approach to this care, bringing many different clinical specialists together to focus on the patient as an individual and on the needs of his or her family.

This Brain Injury Family Guide was written to help you understand how the brain functions and how brain injuries affect a person who has sustained an injury.

Some words that are highlighted in bold print may be unfamiliar to you and are explained in diagrams or in the glossary provided at the end of this book.

This guide also will help you understand what to expect during your family member’s rehabilitation program and how you can help in the recovery process. Your treatment team at Bryn Mawr Rehab Hospital is experienced and committed and will work closely with you to provide ongoing information and support through what can be a lengthy and challenging recovery process.
II. The Brain: Structure and Function

The brain is very complex. Researchers are constantly making new discoveries about how it functions. It is possible through a basic explanation of this organ to understand some of the experiences your family member may have and predict or explain some of the behaviors he or she may be exhibiting.

Though the brain looks like a uniform structure, it is actually divided into many parts that perform very particular functions. Many of these different brain areas are active simultaneously or sequentially during daily activities. Consider, for example, that the simple act of drinking a glass of water requires at least nine separate brain functions. You decide to drink, initiate the act of drinking, receive visual information about the glass, move your arm and hand to the glass, receive sensation from your hand that the glass is in it, coordinate the movement of the glass to your mouth using your hand and arm and then coordinate the sequential movements of your mouth, tongue and throat to take a sip while taking a pause in breathing.

This is quite a bit of activity to occur in just a few seconds. Yet the brain manages to perform these kinds of routine actions regularly and speedily through constant communication between one part of the brain and the next. An injury, however, can interrupt the connections between areas of the brain and make it hard to complete even the simplest tasks.

Although each brain area is involved in many varied functions and each activity requires involvement of many brain areas, certain types of deficits commonly occur after an injury to a specific part of the brain. In fact, in some cases, the areas of the brain that have been damaged can be identified by the changes the individual exhibits afterward.

As the director of all of the body’s functions, the brain uses a great many resources. At least 20 percent of the blood the heart pumps goes to the brain and several million nerve cells send, receive and interpret messages that keep us functioning and acting purposefully.
Brain Structure
The brain is divided into three main regions: the brain stem, the cerebellum, and the cerebrum. The two cerebral hemispheres of the cerebrum are, in turn, divided into four lobes. These areas are identified in Diagrams 1 and 2.

Skull
The bones that come together to completely cover and protect the brain.

Brain Stem
Although this area is small, it plays a very important role in many brain functions. Injuries to the brain stem can affect motor function, eye movements, speech, swallowing and the level of consciousness.

Cerebellum
This area is particularly important in coordination and balance.

Cerebrum
The largest part of the brain, it is divided into the left and right cerebral hemispheres. Generally, each hemisphere directs the motor and sensory functions for the opposite side of the body (i.e., the left hemisphere controls the right side of the body and vice versa). The hemispheres also have specific roles. For example, the left hemisphere of right-handed people controls language functions, and the right hemisphere is particularly important in visual-spatial functions.

Each hemisphere of the cerebrum is then divided into four lobes (as noted in Diagram 2), which have specific functions:

The Frontal Lobe controls personality, expression of emotion, storage of information, abstract thought, problem-solving, ability to organize, concentration, and the ability to initiate action and movement.

The Parietal Lobe is important in sensation, perception, attention and complex aspects of brain processing.

The Temporal Lobe regulates memory function, language information and behavior.

The Occipital Lobe is responsible for aspects of visual function.
It is important to understand the function of the brain and where these functions are located within the brain. Diagram 2 shows the brain areas that are involved in vision, speech, movement, sensation and hearing.

No two people have the same brain injury, so the recovery process and the long-term effects of an injury will be unique to the individual who experiences them. This is extremely important to understand because one cannot compare the amount or rate of recovery of two patients without considering the severity and nature of the underlying injury. If the person sharing the room with your family member appears to be improving at a different rate, remind yourself that each case is different. This will help eliminate a lot of unnecessary worry on your part.

III. Types of Brain Injuries

Brain injuries are identified by the cause of the injury, such as traumatic brain injury (TBI), aneurysm, anoxia, intracerebral hemorrhage, brain tumor or encephalitis.

The major types of brain injury are each described below. Although these are explained individually, often a patient’s actual injury is a combination of these processes.

A. Traumatic Brain Injuries

Traumatic brain injuries include penetrating open injury, such as a gunshot wound, or closed head injury, such as one resulting from an assault, fall or motor vehicle accident.

Following a traumatic brain injury, there may not be any overlying injury to the skin or skull, so the person’s appearance may not look different. Also, the maximal injury may not be directly at or under the site of the blow (impact). For example, when the site of maximal damage to the brain is opposite to the site of impact, this is referred to as a “contrecoup” injury.

Two ways to describe Traumatic Brain Injuries are as Diffuse Axonal Injury and Focal Injury.

Diffuse Axonal Injury

Brain cells (neurons) have long thin projections called axons, which carry electrical messages from one brain cell to the next. Trauma can disrupt or break these
“axonal” connections in many different parts of the brain. This is called **diffuse axonal injury (DAI)**. Even very small DAI lesions have profound clinical effects, since they involve densely packed bundles of axons located deep within the brain.

Because axonal injury is microscopic, it often is hard to detect on **Computed Tomography (CT)** or **Magnetic Resonance Imaging (MRI)** scans. Damage at the cell level continues over several days, therefore MRI or CT scans done after the injury may gradually start to show a pattern of problem areas, or increased areas of density from edema (swelling) and breakdown of brain cells.

As cells begin to breakdown and leak fluid into the brain tissue, other cells and blood vessels near the trauma may also burst and create additional axonal damage in a cascading effect. Patients with this type of injury sometimes have prolonged unconsciousness despite relatively normal CT scans. As a result of this widespread microscopic injury to axons, MRI scans done several months after injury often show atrophy, or a loss of brain substance.

Generally, the longer the unresponsiveness, the more severe the damage. If the coma is brief, patients with this type of injury often recover well. Nonetheless, during their rehabilitation they may have problems with such things as impaired concentration and mental control, impulsivity, denial of disability, impaired problem solving and reasoning, forgetfulness, mood swings and personality change. Subtle problems with balance, eye movements and reaction time may also be seen. Patients with more severe injury and more prolonged unresponsiveness may have more weakness, increased stiffness in the arms or legs, eye movement abnormalities, severe dysarthria (unclear speech), ataxia (impaired balance or coordination), temper outbursts and marked slowness in all activities.
Focal Injury: Contusion, Hemorrhage and Infarction

A focal injury, or injury to a specific area of the brain, is another way to describe damage to the brain as a result of trauma. This is different from diffuse axonal injury. However, some patients may have both of these types of injuries. A focal injury can be a

- **Contusion**
  *Bruising of an area of the brain*

- **Intracerebral hemorrhage**
  *Bleeding within the brain*

- **Infarction**
  *Loss of blood supply to a part of the brain*

Focal injuries impact sensory and motor functioning by disrupting pathways deep within the brain that enable an individual to learn new information, reason and speak logically. Recall that certain areas of the brain have special functions. Loss of function depends on the extent of the focal injury and what areas of the brain are injured. (See Diagram 2)

Recovery from focal injury depends on the amount and location of the damage. Keep in mind that a focal injury to the left side of the brain usually causes weakness (a motor function) of the right side of the body and vice versa.

**Contusions**

Contusions occur most commonly in the frontal and temporal lobes in TBI from blows to the front or side of the head. Injury to the frontal or temporal lobes (see Diagram 2) may affect day to day activities of a person in different ways. Frontal lobe injury can result in poor initiation or motivation, decreased spontaneity in behavior, lack of concern, reduced sexual interest, decreased emotional expression and inability to problem solve and plan ahead. Alternatively, frontal lobe injury can also cause a childish attitude, sexual disinhibition, inappropriate irritability and anger, aggressive outbursts or a lack of concern for others.

Temporal lobe injury, on the other hand, is associated with memory difficulties, personality change and an increased tendency for seizures. Patients with injury to the left temporal lobe specifically may also have aphasia, an impairment of language function. Memory impairment is more likely to be severe if both temporal lobes are injured.

**Intracerebral Hemorrhage**

When there is bleeding into the brain tissue, it is known as an intracerebral hemorrhage. This can be caused by a burst blood vessel after a trauma to the brain. In any event, the result is the destruction of brain tissue and brain cells as the blood supply that nourishes this tissue is lost. In addition, the bleeding causes the brain tissue to swell and puts increased pressure on the brain itself and the skull. At times, surgery may be required to control this bleeding. Loss of function depends on the area of the brain affected. Other types of brain injuries related to intracerebral hemorrhage are described later.
Infarction

An infarction is a term used to describe what happens after a loss of blood supply. When an area of brain tissue is infarcted, the brain cells and tissues no longer receive oxygen and nourishment. When this occurs over a period of time, the tissues and cells die. These infarcted areas are then permanently damaged.

With the help of her therapists in the hospital’s Day Treatment Program, Katie is learning to walk again. “We are grateful for every small sign of progress,” her mother says. “There is something new to celebrate almost every day.”

B. Tumors and Other Non-traumatic Brain Injuries

Brain Tumors

Brain tumors are collections of abnormal cells that grow faster than normal cells within the skull. A brain tumor may start in the brain itself or spread from a cancer elsewhere in the body. As the tumor grows, direct pressure is placed on that area of the brain causing neurological deficits. Injury may also occur as a result of generalized brain swelling (cerebral edema), pressure within the skull (increased intracranial pressure), bleeding at the site (hemorrhage) or obstruction to the flow of cerebrospinal fluid (hydrocephalus). Depending on the type, location and size of the tumor, it may be treated with surgery, radiation or chemotherapy.

Epidural and Subdural Hematoma

Bleeding sometimes occurs outside the brain but still inside the skull. This leaves less room for the underlying brain, which can get squeezed or damaged. The two main types of such bleeding are epidural hematoma (a collection of blood over the brain’s protective covering called the dura) and subdural hematoma (blood under the dura). Lasting problems in this type of injury are often attributable to the contusion (bruising) or infarction (loss of blood supply) of the brain tissue under
the hematoma. Secondary damage can also occur to the brainstem, which can be an important cause of residual impairments.

Anoxia

Brain cells need a constant supply of blood to provide them with oxygen and nutrients. When the amount of oxygen reaching the brain is interrupted, brain cells are damaged by an anoxic brain injury. This type of injury may occur following a heart attack, respiratory failure, near drowning, carbon monoxide poisoning or traumatic brain injury. Common problems with anoxia include decreased attention, gait and balance difficulty and memory impairment. The attention and gait problems often recover well; the memory problems are often more persistent.

Cerebral Aneurysms and Subarachnoid Hemorrhage

Cerebral aneurysms are sac-like enlargements in the wall of an artery in the brain. They most often occur at places where the arteries branch. When these aneurysms burst, blood often rushes into the subarachnoid space and causes a subarachnoid hemorrhage. The aneurysm can be repaired during surgery, or Guglielmi Detachable Coils may be placed inside the aneurysm using a catheter threaded internally up through the artery. The location of the aneurysm is important in the type of problems encountered by these individuals. For example, patients with aneurysms of the anterior cerebral or anterior communicating artery often have problems with initiation, memory and leg movement. Specific medications can sometimes help these patients initiate better.

Arteriovenous Malformation (AVM) and Intracerebral Hemorrhage

Intracerebral hemorrhage refers to bleeding directly into the substance of the brain. Causes can include high blood pressure and disordered blood clotting. An arteriovenous malformation (AVM) can also cause intra-cerebral hemorrhage. An AVM is a congenital malformation of the arteries and veins in the brain. These blood vessels are thin and fragile and, as with an aneurysm, may rupture and cause bleeding in the brain.

Encephalitis

Encephalitis can be caused by a number of different viruses or from long-term disorders in kidney and/or liver functions whereby the body does not clear out toxins in the blood. Herpes Simplex Type 1 is a common cause of encephalitis, and can be treated with antiviral drugs. Problems with memory, language, personality and behavior are often seen with Herpes Encephalitis, largely attributable to the predilection of the virus for the temporal lobes.
IV. What to Expect: Prognosis

Often the most honest (and frustrating) answer is that no one knows for certain what a person’s final recovery will be after a brain injury, however, here are some useful guidelines.

- Significant recovery can occur even after severe brain injuries.
- Severe confusion is common soon after injury and can be temporary.
- No one can reliably quote a period of time in which recovery stops. Many patients have continued to show progress after completing the inpatient rehabilitation program.
- Sometimes the rate of recovery can be frustratingly slow, although progress is occurring. Rapid change is most likely in the first few months after injury.
- In severe brain injuries, even after significant recovery, residual problems almost always remain. Frequently problems with personality changes, concentration, memory, problem solving, temper control, headaches or depression continue even when physical problems are no longer noticeable. In other patients, problems with walking, speech, vision or coordination may be more persistent. Many patients recover to the point of leading full and meaningful lives. However, roles and relationships frequently change.
- The best estimates for recovery are done on an individual basis and with an understanding of the type and extent of injury, as well as prior personal characteristics.
- Medical personnel in both acute care and rehabilitation hospitals use several diagnostic tools to assess the damage an injury has caused to a person. These tools include measurement scales that gauge a person’s response and function and diagnostic tests that ascertain the location and, to some degree, severity of the injury.

A recommendation:
Look, test and evaluate each day for changes. Work with the doctors, therapists and nurses to establish clear evaluation techniques. Track the things you see in a logbook and, after a week or two weeks, read back over your notes. It will be easier to see changes over a period of time.
How Recovery Occurs

As mentioned, considerable recovery can occur even after severe brain injury. Several processes are probably responsible for recovery.

• Brain swelling goes away and the pressure inside the skull becomes normal, usually within a few weeks. The chemical balance in the brain returns toward normal within several months.

• Research has shown that new connections may develop between nerve cells over an extended time period.

• Existing connections between nerve cells may be used in new ways. This is particularly exciting from a rehabilitation standpoint. Consider this example to understand how existing connections can carry new information. If you want to fly to Los Angeles from Philadelphia, you probably would prefer a direct flight. But if no direct flights are available, you could fly to Atlanta and catch another flight to Denver, where you would board a plane to take the last leg of your trip to Los Angeles. This rerouting process is similar to what can happen to nerve connections in the brain after patients are shown proper retraining techniques.

• One of the most exciting recent discoveries has been that training can facilitate brain recovery. Through intensive physical and occupational therapy called Movement Induced Therapy, undamaged areas of the brain can be trained to take over for damaged areas. For example, we retrain patients to walk using a harness system that safely suspends a patient above a treadmill. Brain imaging has shown that remapping of the brain’s neurons occurs fairly rapidly with this kind of stimulation. Another form of Movement Induced Therapy involves forcing the use of the arm and hand on the weaker side of the body by restricting use of the “good” arm and hand.
V. Stages Of Recovery

As time passes, patients go through stages of recovery that can be described in terms of their level of responsiveness, function or behavior. In fact, some behaviors commonly seen in brain-injured patients are characteristic of their stage of recovery rather than their type of injury. Levels or states of recovery are often referred to by the treating team as the patients’ Rancho Levels, which are described in more detail below.

It should be kept in mind, however, that these levels are not distinct but rather represent a continuum of recovery in arousal and attention. Furthermore, patients with significant focal injuries, such as contusions, hemorrhages and infarction, may not “fit” into the levels as traditionally described. So, the concept of stages of recovery is important, but we do not place as much importance on Rancho Levels now as we did in years past.

Measuring Responsiveness

It is important to measure and document recovery (exactly what the person is doing, eye contact, visual tracking, inconsistent responses) so that proper services can be provided to enable optimal recovery. To evaluate the specific clinical changes of the minimally responsive patient, for example, the Coma Recovery Scale Revised (CRS-R) is used. The CRS-R is a standardized tool that provides clinicians with quantifiable information. The CRS-R has six areas of evaluation: auditory, visual, motor, oromotor, communication and arousal.

A patient who demonstrates more purposeful responses to a stimulus or the environment receives a higher score. An individual who can only provide a generalized or reflexive response receives a lower score. The CRS-R, along with Rancho descriptions of recovery states, help us chart progress and plan treatment.
Levels of Awareness

Emerging from Coma

Unlike immediate reawakenings you see on television, emergence from coma may be very gradual in people with severe brain injuries. Technically, if your family member’s eyes are open, he or she is no longer in a coma. However, eye opening may occur before return of consciousness, which is the ability to respond to the environment in a purposeful way. Such responses may include following simple commands, assisting in therapy, following objects with their eyes or having facial expressions signifying emotions.

The sequence of returning function varies widely. One example is

• eye opening is followed by eye contact
• eye contact is followed by visual tracking
• visual tracking is followed by the ability to follow commands inconsistently
• inconsistently following commands is followed by consistently following commands
• consistently following commands is followed then by speaking. Speech is usually the function that is slowest to return.
Minimally Conscious State

As patients emerge from coma, they enter a state that may be referred to as minimally conscious. The minimally conscious person is still severely disabled with significant dependent care needs. The rehabilitation team continually looks for new signs of purposeful responses and reinforces them with multi-sensory stimulation, such as range-of-motion exercises, movement stimulation, changing the patient’s position and using visual images and verbal reassurances.

Minimally conscious patients gradually progress from inconsistent responses to more consistent responses. Initially, responses may be noted only with certain people, especially with those who know the patient well or who are with the patient for extended periods of time.

Family members can assist in this process by engaging in direct, uncomplicated activities for short periods of time and explaining what is happening in very simple terms (“I am holding your hand now”), using a calm speaking voice. Encourage the person to look at you and others in the room when his or her eyes are open. It is important not to overstimulate someone at this level as this may cause confusion and a temporary inability to respond (“shutdown”). Presenting only one simple, familiar stimulation at a time and allowing additional response time are techniques to avoid this problem.

As responses to commands become more consistent, you can continue to ask your family member to follow these commands as well as ask basic “yes” or “no” questions. This period of growing awareness is also a time to begin orienting your family member to who and where he or she is and what has happened.

Agitated State

As patients become more aware, a phase of restless, agitated or aggressive behavior, often accompanied by confusion, can occur. These behaviors can be part of the recovery process and your family member will not necessarily exhibit them long-term.

During this time, the rehabilitation team will reduce distracting stimuli (such as television and radio), will try to establish normal sleep/wake patterns and will create as protected an environment as possible. Protection may include the use of mats or a specially designed bed to allow the patient to move freely without harm and with the least amount of restraint necessary. Behavior management strategies and medications are also helpful for some patients.

For patients with behavioral problems, the neuropsychologist and physician together develop the behavior plan with input from the clinical staff treating the patient. A logbook is usually kept so that a decrease in agitation can be monitored. This behavior plan identifies the target behaviors that need to be improved and the negative behaviors that the patient displays.

You can help by participating in the behavior management plan. These interventions vary, based on what seems to precipitate each patient’s behavioral outbursts. Stimulation that could be promoting agitation is carefully controlled. You can continue to seek responses to commands and questions, but speak in gentle, low tones and move about quietly.
and slowly. You can set limits to very inappropriate behavior, but do not expect to control or rationalize the patient into “normal” behavior. This is a stage that requires a great deal of tolerance by all.

It is important to remember that this agitated stage is a step in the recovery process. Though these behaviors may be difficult to watch and respond to, they are often a sign of improvement.

Confusional State
Most patients pass through a period of confusion in which they have difficulty maintaining a coherent line of thought. Confusion typically accompanies agitation. In this stage, patients do not recall new information and may not be oriented to time or place. It is possible that your family member will go through a long period of confusion, especially if he or she has had a long period of unresponsiveness.

Improvements in attention are usually gradual at this point, but learning still can take place during this stage. As patients become less confused, their ability to focus on a task and recall daily events often improves. To aid your family member, ask simple questions that will encourage memory and offer generous words of encouragement and praise for the answers. Do not treat the person as a child because his or her thinking is muddled, but continue to be as honest and direct as possible.

As your family member progresses in this stage, help him or her get organized to do simple daily tasks and begin building greater independence by offering only occasional support to complete these tasks.

The patient’s tolerance levels for activities may still be low, so show great patience and maintain realistic expectations.

Higher Cognitive State
Although patients who reach this stage may be medically stable, they may continue to have physical and/or cognitive deficits. As confusion clears, specific physical or cognitive deficits may persist. These deficits relate to the area of the brain that was damaged. Treatment is aimed at helping the patient recognize these deficits, develop independence, solve problems, and display appropriate social behavior.

As the time to leave the hospital nears, patients may experience anticipation anxiety about the imminent return to family, community and school, which may be manifested as ambivalence about or disinterest in the future. Psychological counseling can help you and your family member find appropriate coping skills to deal with major lifestyle adjustments required by lingering disabilities. Our team provides resources to help family members and patients plan for the future.

Adaptation and coping skills are a primary focus of the team as the brain injured survivor and his or her family progress toward realistic goals. In this stage, you will need to encourage and expect full participation by your family member in daily activities. He or she should begin taking responsibility for personal care and should begin to use those strategies that will help compensate for cognitive and/or physical deficits.
A person with a brain injury and his or her family are the central members of a team that includes many different clinical specialists. These specialists work to address the specific cognitive, behavioral, physical and emotional difficulties that an individual can face after a brain injury. They are trained to care for each person uniquely and to help patients and families set goals.

The comprehensive treatment team includes a neurological rehabilitation physician, internal medicine physician, case manager, rehabilitation nurse, physical therapist, occupational therapist, speech therapist, psychologist, cognitive therapist, recreation therapist, pharmacist and registered dietitian.

These clinical specialists work with the patient and family to create a tailored program of care. The group then meets regularly with the patient and family to monitor and evaluate the patient’s changing abilities or responses and revise the plan as needed. All clinical team members thus contribute to an integrated team approach while providing treatment in their own specialty areas. This method ensures that each team member is aware of all functional goals so his or her treatment is consistent.

In this section we will describe who the team members are and how each member contributes to successful patient care.
The Treatment Team

Physicians

Rehabilitative care for a person with a brain injury is usually directed by two physicians 1) an attending neurologist or rehabilitation physician, who directs and coordinates the rehabilitation process, and 2) a consulting internal medicine physician, who keeps the patient medically stable so he or she can participate as fully as possible in therapy.

The rehabilitation physician is either a neurologist with special expertise in neurorehabilitation or a physiatrist, who is a specialist in physical medicine and rehabilitation. Physicians are available within the hospital 24 hours a day, seven days a week.

Cardiologists, ophthalmologists, gastroenterologists, otolaryngologists (ENTs), orthopedic surgeons, psychiatrists, neurosurgeons, urologists, podiatrists and other specialty physicians also may be asked to consult about treatment.

Case Managers

A case manager is assigned to each patient. The case manager serves as a liaison between the patient, the family, the insurance company and the treatment team. Communication with the case manager will continue throughout your family member’s stay and after discharge for specific follow-up questions. To assist you in communicating with the insurance company, the case manager keeps the insurance company updated on your family member’s progress. You can direct any questions regarding insurance coverage to the case manager.

One of the main roles of the case manager is to assist you in the decision-making process regarding your family member’s discharge. Setting realistic discharge goals may not be easy. It is important that you be able to make an informed decision regarding discharge to an environment that will meet his or her needs. To help with this process, your case manager will give you information from patient care conferences and from ongoing interaction.
with treatment team members. You will be encouraged to participate in your family member’s therapies to broaden your knowledge regarding his or her needs and abilities. Remember, early family involvement will enable you to make informed decisions for discharge planning later. The case manager shares resource information and may make suggestions about or referrals to an appropriate facility or agency for continuing support after discharge.

Rehabilitation Nurses

Nursing staff monitors each patient 24 hours a day. Rehabilitation nurses, who are registered nurses (RNs) and licensed practical nurses (LPNs), combine traditional patient care skills with expertise in rehabilitation. They plan, implement and evaluate each patient’s nursing care. They also teach patients with brain injuries to care for themselves and foster as much independence as possible. The rehabilitation nurse coordinates all nursing care and is a source of information for you, your family member and the other staff members. Rehabilitation nurses are supported by rehab techs, who are similar to nursing assistants, but their skills are broader and include therapy assistance and phlebotomy. Working as a team, the nurses and rehab techs reinforce the skills learned in different therapies by helping the patient practice them on the unit. Working with other members of the treatment team, rehab nurses focus on preventing skin breakdown, encouraging bowel and bladder routines and providing family education. Other nursing resources include a nurse manager, shift supervisors and unit secretaries. Either the nurse manager or the supervisor is available for patient and family questions. The unit rehabilitation coordinator is a valuable resource and can help direct questions to the appropriate resource.
Speech/Language Pathologists

Speech therapists work with the individual who has a brain injury to improve all of the processes involved in communication. They also focus on eating (swallowing) skills.

Treatment begins with evaluations of the patient’s cognitive processes and of the mechanical components of speech and swallowing. A cognitive-linguistic evaluation assesses the person’s ability to understand and organize thoughts and to express them. Additionally, this assessment examines the individual’s attention span and ability to concentrate, as well as his or her orientation, memory, reasoning and problem-solving abilities.

The speech evaluation deals with speech clarity and voice. A swallowing evaluation focuses on the oral structures (lips, tongue and palate) and muscles involved in swallowing, as well as on the ability to eat food and drink liquids of different consistencies and temperatures.

Therapy is based on the results of these evaluations and may involve sessions to improve speech clarity, concentration, memory and problem-solving abilities.

Treatment also may include therapy to help express ideas, read, write and do calculations. Swallowing therapy (called dysphagia therapy) focuses on oral-motor control and swallowing function. The speech therapist works closely with the patient’s occupational therapist and rehabilitation nurse to foster improvement in this area.

If necessary, a person’s ability to speak or communicate may be enhanced through the use of an assistive device, such as an augmentative/alternative communication device (AAC). AACs help people who cannot communicate express their needs, feelings and ideas. The speech therapist evaluates the person’s communicative function and assists in choosing the most appropriate device. He or she then trains the individual, the family and necessary staff members in the use of the device.

The speech therapist can screen for hearing loss as required. And he or she can also offer a comprehensive screening for the loss of taste and smell – a common effect of brain injury.

Occupational Therapists

The goal of occupational therapy is to help regain the skills needed for daily life and work. The occupational therapist works with you and your family member to plan a treatment program that helps achieve the chosen recovery goals and enables the patient to return to a meaningful and productive life.

Occupational therapists evaluate the individual’s strengths, needs and ability to perform self-care functions such as
dressing, grooming and bathing. They also evaluate work, school and home management skills such as shopping, cooking, budgeting and leisure activities. An assessment is made of how the individual perceives and interacts with the environment.

Based on this evaluation, the occupational therapist recommends and works with the individual on a program of special techniques and purposeful activities that will help overcome, or compensate for, problem areas. You will be invited and encouraged to participate in your family member’s therapies as much as possible. The therapist works with the patient and family members to set up an individualized treatment program focused on building independence.

Some of the techniques and activities the therapist may use include:

- Compensating for self-care inabilities, such as one-handed dressing, bathing or grooming techniques.
- Custom-fabricated splints (orthoses) and positioning devices to maintain functioning and prevent deformities in the joints of arms and hands.
- Cognitive, sensory and perceptual retraining to improve the ability to perceive the environment and overall ability to learn.
- Strengthening muscles to increase the ability to perform daily activities such as bathing, dressing, cooking and getting on and off the toilet.
- Life skills training in such areas as money management, map reading, shopping and safety awareness to help re-enter the community.
- Identifying adaptations for home, work, school and other environments.
- Family education to prepare you and your family member for discharge.

Physical Therapists

Physical therapy relies on education and specific treatment methods (called modalities), including exercises given in both individual and group sessions. Therapy may include exercises to improve strength and mobility, as well as activities to improve balance and coordination.
Functional activities such as transfers, getting in and out of a chair or a car, moving in bed, walking or gaining wheelchair skills may also be part of treatment sessions later in the rehabilitation care plan. Other modalities such as hot packs, ultrasound or electrical stimulation may be used to relieve discomfort and to increase the ability to move. Family education and training is essential in preparing your family member for discharge. The therapist works with you and your family member to assess and make recommendations about equipment needs and to train you both in their use.

Psychologists

While physical strengthening is a vital part of the rehabilitation program, recovery also involves attention to emotional and cognitive needs. Both you and your family member have undergone a tremendously difficult period. A psychologist, a specialist in the study of human behavior and neurological function, may be able to help you both during this time.

Our psychologists have been specially educated to assess and discuss the special concerns that a brain-injured person may have. The psychologist usually sees the patient several times a week in both individual and group therapies and evaluates the person’s cognitive and emotional abilities. Psychologists also create programs to assist patients with behavior management.

Family members may need to make significant adjustments in their lives after the injury. Family roles often change. Your psychologist can work with you to deal with reactions to your family member’s condition and relationships to one another. The support and problem-solving provided in individual, group and family therapy also may help the whole family improve stress management and coping abilities. Your psychologist can refer you and your family members to the appropriate support groups. (See Appendix) The psychologist also may recommend additional interventions for the
patient such as biofeedback training for the control of stress and pain.

Neuropsychologists, specialists in understanding the impact of brain injuries on behavior, are also a part of the treatment team. Neuropsychologists use standardized neuropsychological and psychological tests to help identify deficits and clarify the patient’s cognitive, vocational and interpersonal goals.

Specialized cognitive therapy provides re-education and retraining to address the cognitive deficits that can affect a person’s work, school and home life. Typically, cognitive remediation focuses on improving or helping the patient compensate for problems in one or more of the following cognitive skills: attention, concentration, orientation, memory, local reasoning, speed of processing, problem-solving, visual-spatial skills, organizational and academic skills. Based on an individual’s specific needs, a treatment plan will be created by the team and implemented during the rehabilitation stay.

Pharmacists

Medication management plays an important role in the successful recovery of our patients. Clinical pharmacists are located on the patient care units throughout the day to answer team members’ questions about specific drug safety and medical effectiveness. Having a pharmacist in such easy reach provides better education for patients and families as well as clinical staff.

Registered Dietitians

Recovery may involve a change in diet to help decrease any health risks associated with the brain injury and increase an overall sense of well-being. The ability of a person recovering from a brain injury to swallow normal food may be a problem. Some patients may not be able to swallow at all without food entering the lungs. Different consistencies (thicknesses) of food or drink sometimes are necessary. A registered dietitian can help create a personalized nutrition program for the person with the brain injury that will meet dietary needs and preferences as well as address specific therapeutic goals. The dietitian can help compensate for a swallowing disorder or can help make the transition from tube feeding to a broader diet.

Recreational Therapists

Recreational therapists help patients re-enter the community by applying practical skills to real-life situations. They address areas such as time management, healthy lifestyle practices, leisure interests and problem solving for community barriers. These barriers may be architectural, attitudinal or functional. When appropriate, therapy takes place in a community setting.
VII. The Effects of Brain Injuries

Each person with a brain injury has had a unique injury and will experience a unique recovery process. Several common effects of brain injuries are described in this section. As you read through, remember that only some may apply to your family member.

A. Nutrition and Eating

Proper nutrition is essential to healing. Evaluations are performed to determine the best means for a patient to maintain adequate nutrition. Physical and cognitive changes, such as diminished attention, poor hand coordination and difficulty in swallowing can disrupt normal eating habits. Retraining efforts through nursing, occupational therapy and speech therapy can help a person recover eating abilities.

**Dysphagia** is the term that describes swallowing disorders. A swallowing disorder can occur at various points along the food’s path to the stomach. The person may have a problem drinking liquids, chewing regular food consistencies adequately and/or completely swallowing all the food in the mouth. Some signs of dysphagia include a wet (or “gurgly”) sounding voice, coughing and/or choking. Such symptoms can occur before, during or after a meal.

It is important to recognize that placing food into someone’s mouth and having it disappear without any outward signs of choking does not assure that the food has been swallowed safely. In a significant number of patients, particularly if they are just emerging from coma or show confusion, food can enter the trachea (windpipe) and proceed to the lungs, where it can cause pneumonia.

A speech/language pathologist conducts an evaluation to determine a person’s level of safety in swallowing. This evaluation can be done with a special x-ray study, called a **video fluoroscopic swallowing study**, which can help assess under what conditions swallowing may be safe and offers direction for swallowing therapy.

Many people are able to eat only under certain conditions. For example, they may tolerate small amounts of a selected food consistency (a soft diet, for example) in a carefully controlled therapy setting where...
someone is reminding them to swallow and checking that the food is not stuck in the cheek. This same person may be at significant risk if fed under even slightly different conditions. Such patients may require tube feedings to maintain or supplement adequate nutrition.

The feeding tube will maintain proper nutrition until a patient is able to swallow properly again. Several feeding tubes are common.

- The **nasogastric (NG)** tube, which does not require a surgical procedure for use and is passed through the patient’s nose and into the stomach
- The **jejunostomy (J)** tube, which is surgically inserted directly into the small intestine
- The **gastrostomy (G)** tube, which is inserted directly into the stomach.

Nursing staff will provide care for these tubes throughout the rehab stay. Family members may be taught how to care for these tubes as well. Feeding tubes need to stay in place for a period of time once they are surgically placed. Premature removal may cause complications. How soon a tube can be removed depends upon the type of tube and how the tube was inserted.

**Incontinence of Bowel and Bladder**

The inability to control bowel and bladder functions is common for people recovering from a brain injury. Many techniques can be used to improve function. For example, diet, water, exercise and daily routines can help regulate the emptying of the bowel. At times, laxatives and suppositories may also be used. Sometimes a catheter is needed to remove urine from the bladder.

Taking the person to the bathroom at scheduled times (time voiding) can improve bladder management and help regain bladder muscle tone. Both bowel and bladder functions also may be improved by changes in diet and regular exercise.

**B. Motion and Balance**

**Sensorimotor effects** refer to the relationship between movement and sensory perceptions. The brain interprets sensations and directs appropriate physical motion in response. Any of several movement disorders can result if a brain injury interrupts the smooth operation of this process.

Different types and levels of paralysis can affect different parts of the body and last for unpredictable periods of time. **Hemiparesis**
is weakness on one side of the body; when this weakness is more severe, it is called hemiplegia.

Motor control of muscles or limbs can decrease because the injury has affected the way the brain directs the muscles to move. This can result in complete or partial interruption of certain movements, uncontrollable spasms, and/or a general inability to control movements.

A person’s balance and coordination also may be affected by a brain injury. Because balance depends upon vision, hearing and sense of position reaching the brain and being properly analyzed there, any interruption in these connections can disrupt balance. Poor coordination can be caused by injury to the cerebellum or portions of the inner ear and their connections to the brain. Called ataxia, this condition can interfere with the performance of even the most basic movements and tasks.

Muscle Tone and Range of Motion

Muscle tone is frequently abnormal after a brain injury. Sometimes muscle tenseness may increase with movement. This is called spasticity. These changes in muscle tone can be painful and can lead to decreased range of movement and abnormal posture. For example, the arms may be held tightly across the chest and the legs may be held in a straight, rigid position.

Treatment for abnormal muscle tone includes exercise to normalize the tone, gain posture control and improve flexibility. These may include slow rocking, range-of-motion exercises, balance training and serial casting. Serial casting is used by physical and occupational therapists to increase the injured person’s range of motion in a specific joint. Serial casting is the use of plaster casts, changed regularly on specific joints, most often the elbows and ankles. When the desired range is achieved, casts may be removed, cut in
half and used as resting splints to maintain range of motion.

Anti-spasticity medication, selected nerve block injections, and selected muscle injections may also be used. Orthopedic or neurosurgical procedures may be required in severe or chronic situations. A nerve block may be given to a patient under a local anesthetic. These blocks are injections of medications similar to Botox that allow the muscles of an arm or a leg to relax more and the joints to move more while decreasing pain. Sometimes spasms and tone in a muscle group are very severe and respond better to a constant release of medication that is implanted in a pumping device under the skin. This is referred to as a Baclofen Pump. The medication reservoir is inserted into the abdomen and a catheter that is attached to this reservoir releases medicine (in this case baclofen) into the proper spaces at a small, constant rate. This keeps muscle spasticity and pain lower.

Various pieces of equipment may be prescribed to encourage or maintain normal posture, including specialized wheelchairs, sidelyers, serial casting and splints. Wheelchairs with firm seats and backs, trunk and thigh supports, head rests and leg cradles can be individually adjusted to allow for a well-balanced, relaxed posture.

Mobility of the wrists, hands, ankles and feet may be affected—they can stiffen in an awkward position. Plastic splints, made by occupational therapists, are used on an individual to hold joints in a normal position and prevent deformity.

Many different pieces of adaptive equipment may be used to allow a person with a brain injury to be more independent.

Other Complications

It is not uncommon for other complications to occur after a brain injury. These include the following.

Fever

If fever occurs, a diagnostic work up may be needed to help find the cause. This may include a blood test, urine test or an x-ray. Fevers are most often caused by urinary tract infection or pneumonia, and these can be treated with antibiotics.

Fractures

Many people who sustain traumatic brain injury also sustain fractures. Rehabilitative
care can assist in recovery from effects of these injuries and orthopedic care can continue in the rehabilitation setting. The rehabilitation team maintains special precautions if fractures require a patient to avoid putting weight on a broken bone.

Heterotopic Ossification
Many patients with severe brain injury develop bone in the soft tissue around their joints – usually shoulders, elbows, knees, and hips. This formation, called heterotopic ossification, can cause pain and diminish the range of motion in the affected joints. Range-of-motion therapy in treatment sessions and by nursing can help to alleviate the problem. Such exercises may be used in conjunction with medication. In more severe cases, surgery may be necessary over the long term.

Hydrocephalus
In every person, cerebrospinal fluid (CSF) surrounds the brain and spinal cord. CSF flows through a series of pathways around the brain. The amount of CSF in the skull must be maintained at a relatively constant volume. Usually, this fluid is produced by the body and absorbed back into the body on a continual basis. After a brain injury, the volume of CSF fluid may increase. The excess can be diverted to another area via a drain. This drain is known as a shunt.

Hydrocephalus can be caused by abnormalities in production or reabsorption of CSF or by obstruction of the circulation of the fluid, resulting in enlargement of cerebral ventricles. Hydrocephalus may be a suspected problem if a person begins to deteriorate in mental functioning or physical functioning (suddenly cannot control urination, for example). CT scans and sometimes additional tests may be required to establish this diagnosis.
Problems of Inactivity

The long period of inactivity that may be part of recovering from a brain injury can cause certain physical problems. **General deconditioning** is the generally decreased strength and stamina that a person may experience as a result of extended bed rest. Individual exercise programs can help restore lost muscle strength and physical endurance.

Skin problems such as pressure ulcers can develop after lying in one position for a long time. The best prevention is frequent inspection of the skin, and shifting and repositioning. **Blood clots**, called **deep vein thrombosis (DVT)**, may develop especially in the legs when patients have limited mobility. Although the clots are not always apparent, they may be accompanied by pain, warmth, and swelling. An additional risk is for a clot in the leg to break off and enter the lung (called a **pulmonary embolus**). Anti-coagulant medications frequently are prescribed to manage these conditions. In some patients who may not tolerate anti-coagulants, a filter is sometimes placed surgically in a large vein to prevent clots from going to the lungs.

Seizures

Seizures are common complications in people with traumatic brain injury. The symptoms of a seizure can range from generalized shaking and loss of consciousness, to a single episode of altered attention, emotion, sensation or movement.

Seizures are caused by an abnormal electrical discharge by brain cells. The risk of seizures is greater with prolonged unconsciousness, depressed skull fracture or intracranial hemorrhage. Seizures can be subdivided into early (one to two weeks after injury) and late post-traumatic seizures. Patients with late seizures are generally treated with anti-convulsant medication for a period of years. Patients without late seizures, but at high risk, are sometimes treated with anti-convulsants for briefer intervals.
This term describes any of a variety of speech difficulties caused by muscle weakness or paralysis. The problem could be located anywhere in the mechanism of speech production: the muscles of the mouth, the passageway between nose and mouth, the voice box (larynx) or the respiratory system. Dysarthria can cause slurred speech, abnormal voice quality and drooling because of muscle weakness and decreased sensation.

**Visual Deficits**

Vision can be impaired in one eye, in both eyes, or on one side of the visual field (called **visual field cut** or **hemianopsia**). **Diplopia**, or double vision, is also common after brain injury and is usually due to nerve damage. An eye patch often relieves initial discomfort and improvement usually occurs over several months. If symptoms persist, prism lenses or eye muscle surgery may be considered.

Often, people have visual-spatial difficulty that is not due to nerve damage. This is called visual perceptual deficit and is caused when the brain has difficulty interpreting what is seen. These problems include unilateral neglect, in which a person neglects items located on one side or ignores one side of the body; decreased depth perception, difficulty in perceiving how far away something is and diminished object recognition.

**Other Perceptual Deficits**

Because sensory information is processed in the brain, any of the other senses of hearing, taste, smell and touch may also be affected by a brain injury. The abilities to taste and smell are often diminished and must be compensated for. Hearing itself or the quality of what is heard (**auditory acuity**) may diminish. Certain sensitivities may be heightened, including sensitivity to touch (**tactile defensiveness**) and to movement (**vestibular deficit**). Even the perception of one’s own limbs, their connection to the body and their relationship to the environment may be impaired (**proprioceptive disorder**).
C. Memory, Language and Cognitive Effects

Attention and Concentration

Patients in early recovery often can remain completely alert for only a brief period. Later, it may be difficult for them to focus their attention entirely or to stay with one project or conversation for a significant period without becoming distracted.

Patients can be distracted by their own emotions, thoughts and physical responses or by any element in their environment, such as voices, music, noises or sudden changes in the room. A related concern is an inability to turn one’s attention from one subject to the next.

Memory

Memory impairment, or amnesia, is common after traumatic brain injury. Here are descriptions of three different types of amnesia.

- **Retrograde Amnesia (RA)** is the inability to remember events that occurred during the period of time just before the injury.

- **Anterograde Amnesia** is the ongoing inability to remember events that have occurred since the injury.

- **Post-Traumatic Amnesia (PTA)** is the inability to remember day-to-day events during a period of time after the injury.

Danielle gains confidence in her ability to count money before buying an item in the hospital’s gift shop.
There can still be islands of preserved memory during post-traumatic amnesia, but during this time there is usually a limited attention span. Precise assessment of how much actual memory loss has occurred is difficult. Patients in a confused state often will not remember things because of their severely impaired attention, but they may exhibit good memory function once their attention improves. The duration of post-traumatic amnesia often indicates injury severity.

Every person has different types of memory, and one aspect of memory can be affected differently than another. Memory of things seen (visual memory) differs from memory of things heard (auditory memory), and a strength in one area can be used in therapy to help improve functional memory.

**Short-term memory** is the ability to recall things occurring within a few seconds to a day. **Long-term memory** is the ability to recall things occurring within a longer period of weeks and months, and remote memory is the ability to recall events that occurred many years ago.

Often, remote memory begins to return before short-term or long-term memory. Functionally speaking, it is the ongoing ability to make new, day-to-day memories that is important. Many patients with severe memory difficulty can recall events from years ago, but cannot remember if they had breakfast that day.

People who are confused or who misinterpret events and statements often may offer responses that appear made up. This behavior is a condition called **confabulation**. The person is trying to respond as well as possible to a statement or a situation that may not make any sense and is calling upon different and often unrelated memories to create a response.

It also is important to realize that a person may learn something new and remember it, but not remember the experience of learning it. Research has indicated that some people with brain injury learn information or motor skills taught in a therapy session even though they may not remember the session itself.

### Communication

A brain injury can greatly diminish a person’s ability to understand language and communicate thoughts in return. Language processing may be impaired and, early in recovery, a person may have little or no understanding of words. This can be followed by a period in which some words or commands are known and not others, or some words may be known at one time and not at another. Later in recovery, a patient may not understand complicated statements and may need time to interpret a statement before responding.

**Aphasia** is another type of communication problem in which a person can no longer connect the correct word with a particular object or find the words to express a particular thought. People who have difficulty understanding have **receptive aphasia**; those with difficulty saying or producing speech have **expressive aphasia**. Often, a person may experience both.
A similar problem is **paraphasia**, in which the individual will substitute an incorrect word that may sound like the desired word or relate to its meaning in some way.

People may be able to speak or write correctly, but it is either off the point entirely or becomes irrelevant as it moves further off the point. This is called **tangential communication**. **Perseveration**, when a person repeats a verbal or physical response inappropriately, is also common.

### D. Behavioral Effects

Two of the most striking problems many people with brain injury experience are a **lack of insight** about their condition and denial about their condition. These problems can range from complete denial of obviously severe physical impairments to downplaying the extent or severity of cognitive deficits. As a result, patients often do not take their limitations into account when planning future activities. Family members and rehabilitation staff need to have a realistic appraisal of the patient’s strengths and weaknesses so they can provide guidance for safety, planning and problem solving.

Enclosed net beds may be used to help prevent an individual with a behavioral or cognitive problem from hurting him or herself and prevent falling. Individuals who need these specialty beds are evaluated on an ongoing basis to maintain a safe environment for the patient.

Other pieces of equipment that are used to maintain safety are hand mitts and blue lap belts. Mitts help protect a patient from pulling out a stomach tube, a tracheostomy tube or intravenous line. Lap belts serve as a reminder to get assistance before trying to walk without help. Lack of insight into their deficits may cause brain injured patients to try to walk or go into the bathroom without any help, thinking they are fine. Such behavior reflects how the injury has impacted the thinking process.
Brain injury is a family matter and it affects families in many different ways. Families can undergo many changes as their loved one progresses through stages of recovery. During the initial crisis period, there may have been no time to focus on anything other than the injured relative’s life and problems – yet the health of each family member is important to the overall health of the family. Parents, spouses, children and siblings can all go through difficult reactions unique to their relationship to the injured person. If family balance is not restored, family members can experience isolation, poor health, prolonged fear and depression.

Each family has its own style of expressing feelings, dividing chores and solving problems. All of this may change when a family member acquires a serious disability, particularly a brain injury. It is common that in addition to feeling sad about the loved one’s injury, family members feel a sense of loss for how the family itself has been altered. Family members may relate differently to one another when different demands are put on them.

An especially painful change involves family roles. Families operate like a small organization, providing food, shelter, comfort, support and love. Different people
in the family organization have different roles to play, and those roles go beyond just the traditional definitions of mother and father, son and daughter. For example, the roles can include who listens to emotional problems, who sends out the holiday cards, who takes care of the house repairs. If one family member becomes unavailable due to an injury, the entire system usually changes. People naturally pitch in and help during a crisis, taking on new and additional roles. There can be increased stress on family members as they do things they never thought they would or could do. But once a family member has a disability, pitching in temporarily usually leads to a permanent shift in responsibilities. Often, people have emotional reactions to such permanent role changes that include resistance, sadness, and even guilt at replacing a loved one in a particular function. There are two essential elements for coping with the shifts in roles: openly expressing feelings and enlisting support.

First, family members need to discuss the feelings they have about everything that has happened. For example, they may feel sadness and anger about the accident or illness itself and similar feelings about the changes the event has necessitated. Whatever the exact feelings are – there are no right and wrong ones – expressing them openly and directly is extremely important.

Second, the family needs to rally whatever resources it can to deal with strong feelings and increased demands. The recovery process can be long and stressful. Family members need to assemble a support system of friends and relatives that will help relieve the tension that naturally builds.

Many times families don’t want to ask for help. They don’t want to impose on others or they are embarrassed to be in a needy position. Some people may think, too, that if they must ask for help, then the situation must be very serious. It is important to remember when these feelings arise that
social support can be drawn from many people and many types of organizations. Extended family, neighbors and members of your religious community often are waiting to be asked for help. In addition, support is available from institutions and community groups through hospital staff members, psychologists, and established support groups.

Every family will react differently to the crisis and will find its own means of coping. We are here to give you information and to help you adapt in your own way. We encourage you to use your intuition, participate fully in the rehabilitation program, make suggestions and ask questions. The more information you have about your family member’s recovery, the better able you will be to handle the changes that can arise during the process.

Our hope is that individuals who have experienced a brain injury will return home as independent as possible, with the help of the people who love them. In this way, families can be the most important part of the treatment team, as they will often continue the care of the recovering person at home. We believe much of our job is helping you feel empowered to help your family member. We’ve compiled the following list of suggestions for you to consider, and we invite you to seek our help directly for any issue you might confront.

A. Interacting with the Injured Person

- The personality changes that can accompany a brain injury may be more difficult to cope with than any physical disability. If your family member behaves inappropriately, or in an unfamiliar way, it may be the result of his or her injury. You need not feel embarrassed about behavior that naturally occurs during the recovery process.

- Information may need to be presented to your injured family member as simply as possible. Use straightforward language and direct, uncomplicated gestures and expressions.

- Your family member’s emotional reactions may not be what you would normally expect. They may be heightened or they may be absent. Often the types of reactions displayed may be best explained by the nature of the injury and the stage of recovery at which your loved one may be currently functioning.

- A person recovering from a brain injury sometimes has little capacity to fully grasp the extent of his or her deficits. Do not
assume that your family member feels as you would if you were in his or her situation. Individuals are often unaware of their problems and are not depressed when we would expect them to be. The only way to know how they feel is to ask them. Even behaviors such as laughing or crying do not necessarily mean that the patient is happy or sad. Their behavior can be disconnected from their feelings. As your family member improves, however, so does his or her insight into losses or changes. This is the time when he or she will most need your support and the help of the team.

- People recovering from brain injury often have a diminished capacity for empathy. They are often incapable of seeing any point of view other than their own. Be aware that your family member may not seem as mature as he or she once was, but responding to him or her as one adult to another is still important.

- Try to be objective about your family member’s capabilities. Patients often deny their disabilities and try to influence your point of view about them. You can make your own assessments based on the information that you have.

- Your family member will benefit from structure. Help him or her work through problems by providing input likely to lead in the right direction.

- Your efforts may not always result in immediate improvement. You can feel discouraged and even guilty as a result. It is important then, and at all times, to keep your sense of hope. While it is vital to remain realistic in your goals, you do not need to give up on future possibilities.

B. General Goals

- Take care of yourself and your family – not just your injured relative. It will not help him or her if you become exhausted. Do not be concerned that asking staff members for help for yourself will limit our attention to your relative. We are here to do both.

- Pace yourself. This process can be a long one. Do not expend all of your energy in the early stages because you will need it in the months ahead.

- Remember that dealing with a brain injury is difficult and no one has all the answers. Common sense, however, will carry you a long way. Counseling can also help and can be found through your religious organization or through psychologists, psychiatrists and social workers.

Rehabilitation is hard work for patients and families, and it demands enormous energy and commitment. Our staff provides continual encouragement to keep you going forward.
• Participate in your family member’s rehabilitation program to gain a better understanding of the processes and effects of a brain injury.

• Remember that every person is unique and so an injury to the brain will have unique effects. Try not to compare your family member’s progress to that of others in the rehabilitation program. The treatment team individualizes the care for each person, so your family member is receiving the most appropriate treatment.

• Acknowledge all of your feelings. You may not understand why you feel as you do at certain times, but is important to recognize even those feelings that seem odd or unreasonable. Sharing them with other relatives and friends may also provide some relief; they may be feeling the same way.

• Holding a family get-together, particularly one with dependent children, can be very difficult. Try to describe the situation as honestly as possible. If you are under stress, turn to professionals for help.

• Try to maintain your normal contacts. Stay in touch with relatives and friends and make plans to do recreational activities outside of the hospital. Such outings will help keep you connected to the community.
IX. About Treatment at Bryn Mawr Rehab Hospital

Bryn Mawr Rehab Hospital was one of the first institutions in the country to begin treating individuals with brain injuries, and it has remained a leader for the last 20 years. Our Brain Injury Program was named a regional Center of Excellence by Philadelphia Magazine.

Over the years, the hospital has developed a full continuum of care for people who have experienced a brain injury. This system includes acute inpatient services, outpatient therapy services, Day Treatment, community re-entry services, and an injury prevention program for high school students and the community.

This comprehensive system ensures that all individuals can receive the most appropriate program of care based on their injury and on their personal needs. Treatment can begin anywhere in the continuum – in intensive inpatient care, on an outpatient basis, or in our community re-entry services.

Our overall mission is to help each individual who has sustained a brain injury return to a life of the greatest independence possible. The treatment team works together with individuals and their families to address each person’s specific needs and focus on specific goals in recovery. The key elements in the program are assisting individuals to recover function, developing strategies to compensate for deficits and manage stress, and involving the family and helping them manage their own life changes.

Because each rehabilitation program is unique, treatment plans are rarely alike. Your family member’s length of stay will not be the same as another patient. Despite our best attempt to estimate a discharge date, the actual length of stay may differ from our original estimate. Be assured though, that such changes will always be communicated to you.
Our family-focused services include conferences with the treatment team, family education and support groups, and ongoing participation in care giving. In designing treatment programs, the treatment team makes use of the facilities and specialized services available within Bryn Mawr Rehab Hospital. These include an indoor pool for aquatic therapy, a greenhouse for horticultural therapy, an adapted driving program and an independent living unit for overnight stays so families can practice caring for the patient at home.

Care is provided by a staff of clinicians who are specifically trained in assisting people with brain injuries. The program’s clinical director is a behavioral neurologist, a specialist in the management of patients with cognitive or behavioral difficulties following a brain injury. The clinical director is joined by a staff of physiatrists and internists as well as consulting physicians from many specialties, including orthopedics and behavioral neurology. Services provided by the staff at Bryn Mawr Rehab Hospital are described below.

A. Acute Inpatient Rehabilitation

Within Bryn Mawr Rehab Hospital, our inpatient program is organized in patient care units based upon patient need. Specialized treatment teams assure that patients receive services from professionals most expert in a particular area of care. The brain injury team, led by a neurologist or a rehabilitation physician and a case manager,
includes all of the clinicians and support staff involved in the patient’s direct care. Together, the patient, the family and the treatment team establish realistic, functional goals and work toward those goals in and out of therapy.

While the team develops the patient’s plan of care, the case manager is responsible for implementing the plan and coordinating care for each patient. Under the leadership of the case manager, team members meet regularly to share information and update each other on the patient’s progress. This philosophy, which we call Patient Centered Care, is designed to make each patient’s stay both productive and pleasant, while optimizing patient outcomes.

Families are offered an opportunity to stay overnight with their family member to practice skills before going home. Overnight stays are scheduled by the treatment team.

Other family services include physician/case manager family rounds on the unit, family conferences and education days, whereby family members participate in a full day of therapies. Support groups meet here to offer information, emotional support and social contact both for the person who has experienced the injury and for family and friends. These groups form a support network for families. Relationships with other families facing similar problems are often formed on the inpatient unit.

Family accommodations also are available onsite during a patient’s hospital stay by reservation.

B. Outpatient Rehabilitation

Patients recovering from brain injury often require additional rehabilitation after a hospital stay. Our continuum of care provides outpatient services for those who live at home while continuing in a rehabilitation program.

With more than 28,000 outpatient visits each year, Bryn Mawr Rehab Hospital is one of the largest rehabilitation providers in the entire region. We believe our scheduling flexibility, experienced staff, supplementary services (such as support groups) and
individualized approach offer the greatest opportunity in the Delaware Valley for maximum recovery from injury or illness.

Outpatient care includes medical care as well as physical, occupational and speech therapies, psychology, neuropsychology and assistive technology services. In addition, adapted driving evaluation and instruction is available.

Day Treatment Program

Bryn Mawr Rehab Hospital’s Day Treatment Program is designed for people who are medically stable; who have school, work or community reentry goals; and who are able to tolerate a comprehensive therapy program from 3 to 6 hours a day, 3 to 5 days a week. A unique strength of the Day Treatment Program is the focus on patient and family involvement in setting goals and planning treatment. This approach assures that rehabilitation will be relevant to patients’ lives. When appropriate, therapy is conducted in the environment in which the patient must function – in his or her community, home, work or school.

Our Adolescent Day Treatment Program is specifically designed to address the school re-entry goals of children between the ages of 12 and 18 who have sustained a brain injury.

Mild Traumatic Brain Injury Program

We offer a special evaluation and treatment program for individuals with mild traumatic brain injury who may be experiencing recurrent headaches, confusion, dizziness, memory loss, sudden depression or frequent motion sickness. An important component of the program is a neuropsychological evaluation. Treatment combines a mix of outpatient therapies and education. A team approach allows for a coordinated and comprehensive program designed uniquely for the patient.

Bryn Mawr Rehab Outpatient Network

To better serve Philadelphia’s western suburbs, the Bryn Mawr Rehab Outpatient Network now offers rehabilitation services for the entire family at several convenient locations. Our doctors and therapists are experienced in treating a wide variety of injuries and illnesses, including sports injuries and developmental delays.
X. Glossary

Activities of Daily Living: an individual's self-care routine, including feeding, toileting, dressing, bathing and grooming.

Affect: the motor expression of emotion; how the person appears externally as opposed to how the person feels; sometimes affect (such as crying) may not imply the usual associated feeling (i.e., sadness) in brain-injured patients.

Amnesia: loss or impairment of memory function secondary to brain dysfunction.

Aneurysm: a localized, abnormal dilation of a blood vessel due to a defect or weakness in the vessel wall.

Anomia: difficulty naming things.

Anoxia: lack of oxygen caused by respiratory or circulatory problems.

Anticoagulants: drugs that delay blood clotting.

Anticonvulsants/Anti-Seizure: medications used to prevent seizures.

Antithrombotics: drugs that prevent blood clots from forming.

Aphasia: a loss of previously acquired language function due to damage to the brain; this typically includes impaired comprehension, reading, spelling and writing, as well as verbal expression.

Apraxia: an inability to perform skilled motor acts not attributable to impaired motor strength or coordination, sensation or comprehension; patients may be able to perform an activity spontaneously which they cannot perform on command.

Arousal: a measure of the quantity of wakefulness or consciousness as opposed to its content; lethargic patients have decreased arousal, whereas agitated patients often have increased arousal.

Arteriovenous Malformation (AVM): a malformation of the arteries and veins in the brain. These blood vessels are thin and fragile, and may cause bleeding in the brain.

Ataxia: impaired balance of the body or impaired coordination of an arm or leg.

Attention: a patient’s ability to focus on selected stimuli without distraction and to appropriately shift between stimuli.

Behavior Management Program: Specific plans of care developed by the treatment team to assist patients in appropriate social skills and interactions with others.

Behavior Modification: specific clinical management strategies which reward (reinforce) desired behaviors and discourage (inhibit) undesirable ones. A form of therapy that uses the principles of learning to change behavior. In behavior modification programs, specific rewards and consequences are designated for specific behaviors of the individual with the
intention of increasing more appropriate behaviors and decreasing less appropriate behaviors. The ultimate goal of behavior modification is that the individual will learn to control his/her own behavior without positive or negative consequences being imposed from outside.

**Behavioral Neurologist:** a physician with special training in the management of patients with cognitive or behavior difficulties as a result of brain injury or disease.

**Brain Stem Injury:** an injury to a part of the brain that can affect such things as movement, muscle tone, consciousness, and eye movements.

**Cognition:** a general term referring to all aspects of knowledge and thinking, including attention, concentration, memory, planning and problem solving.

**Cognitive Therapy:** a means by which the brain relearns some of the skills it has lost as a result of brain injury.

**Computerized Axial Tomography (CAT):** Computer x-ray that takes many pictures of the brain at different levels to locate the site and type of damage to the brain. The test, also called a CT scan, is often done soon after the injury to assess the damage and then repeated over time.

**Coma:** a clinical state of unresponsiveness resulting in no speech and no following of commands.

**Concussion:** a temporary loss of consciousness from traumatic brain injury.

**Contusion:** a bruise to a part of the brain.

**Decubitus:** an opening of the skin, obtained in bed, which requires special topical treatment and body positioning to heal. Also called a pressure ulcer or pressure sore.

**Denial:** lack of awareness of one’s self, one’s problems or one’s effect on others.

**Depression:** although sometimes loosely used to refer to depressed mood, the specific psychiatric syndrome of depression is based on additional considerations such as self-esteem, sleep, appetite, or participation in therapy.

**Developmental Sequence:** the normal progression of activities during human development; for example the progression from rolling to crawling to walking.

**Diffuse Axonal Injury:** widespread microscopic injury to nerve connections (axons) along with injury to specific brain structures, including the upper brain stem.

**Diplopia:** double vision.

**Dysarthria:** weakness, slowness, decreased range and/or uncoordinated muscles of the mouth, throat and lungs resulting in problems with clarity of speech.

**Dysphagia:** difficulty in swallowing.
Electroencephalography (EEG): A method of testing that records the electrical activity in the brain (brain waves). This diagnostic tool is often used if a patient has had seizures or to assess passive seizure risk, even if no seizures have occurred.

Epidural Hematoma: a blood clot outside the brain and its lining membrane, the dura; problems are usually the result of compression of the underlying brain, especially the brain stem.

Functional: sufficiently useful for independent use in daily activities.

Glasgow Coma Scale: a scale used to measure coma based on numerical scores for eye opening, speech and limb movements or postures.

Hematoma: a blood clot.

Hemianopia/Hemianopsia: partial blindness in which the left or right visual field is “blackened out” in both eyes.

Hemiparesis: a weakness on one side of the body.

Hemiplegia: a paralysis or complete inability to move one side of the body as a result of injury or damage to the brain.

Hemorrhage: internal or external bleeding.

Heterotopic Ossification: inflammation and deposition of calcium along areas within muscle tissue.

Hydrocephalus: enlargement of the ventricles (cavities) of the brain that normally contain cerebrospinal fluid; a neuro-surgically placed shunt tube can drain fluid from the ventricles to the abdomen.

Incontinence: the inability, due to physical and/or cognitive reasons, to control urination or bowel movements.

Intracerebral Hemorrhage: bleeding inside the brain, caused when a diseased blood vessel bursts and floods surrounding brain tissue with blood.

Ischemia: local interruption of blood supply to tissue.

Magnetic Resonance Imaging (MRI): An imaging procedure that uses a large magnetic field to provide information about damage to the brain tissue.

Metabolic: pertaining to the body’s systems of chemical reactions for tissue production, maintenance or energy use.

Muscle Tone: degree of tension in a muscle.

Nasogastric Tube: a tube which leads directly through the nose and down into the stomach, which allows for nutrition formulas and fluids to be administered.

Neuropsychology: a branch of psychology concerned with understanding how brain dysfunction affects cognitive, emotional, and behavioral performances
of an individual. Neuropsychologists use standardized testing procedures to assess an individual’s performance and to make recommendations regarding cognition.

**Perseveration:** the continued repetition of a word or phrase.

**Physiatrist:** a physician with special training in rehabilitation medicine and the prescription of therapy services.

**Post-traumatic Amnesia:** that period of time after head injury when a person does not reliably recall ongoing day-to-day events.

**Rancho Scale:** a scale of stages of recovery after traumatic brain injury.

**Retrograde Amnesia:** the period of time before injury that the patient does not recall; this period usually shrinks as patients improve.

**Seizure:** a convulsion; clinical seizures can range from generalized shaking with loss of consciousness to episodic strange feelings or sensations; the basis of a seizure is an abnormal electrical discharge in the brain; seizures are generally not damaging to the brain unless they are prolonged.

**Serial Casting:** the use of plaster casting on specific joints (i.e., elbow, ankle) to increase range of motion.

**Shearing Injury:** damage to the brain caused by areas of brain tissue moving in the same direction at different speeds, resulting in diffuse brain damage.

**Short-term Memory:** the ability to learn new information.

**Spatial-Perceptual Deficits:** the inability to judge distance, size, position, rate of movement, form and how parts relate to wholes.

**Spasticity:** exaggerated response of muscles causing stiff and awkward movements and abnormally increased muscle tone; this can be caused by injury to the brain.

**Subdural Hematoma:** a blood collection that forms between the dura and the skull; blood fills up the space under the skull and exerts pressure on the brain.

**Team Conference:** a meeting led by the team physician and case managers; treating staff discuss a patient’s progress, problems, therapy goals and plans and discharge planning issues.

**Tracheostomy:** a tube that goes from the exterior of the throat into the windpipe thus allowing for an adequate exchange of air.

**Tracking:** visual following of an object or sound with the eyes.
XI. Appendix

A. Support Groups and Resource Organizations

Support Groups

We sponsor a network of support groups to help address issues of healing that you and your family may face. Some of the groups are designed for the person who has experienced the injury, while others are directed toward family and friends. The groups all share common goals: to offer information, emotional support and social contact to people who are meeting similar challenges. Through the groups, you and your family can share your feelings and concerns with others who are going through similar experiences.

Your case manager or psychologist can direct you to the leader of each support group and the time and date of the meetings. This information may also be posted on your unit.

Resource Organizations

Brain Injury Association

The goals for the Brain Injury Association are

(1) to increase public, family and professional awareness of brain injury;
(2) to achieve recognition of the problems of brain injury and the needs of brain-injured people;
(3) to assist in the establishment of rehabilitation programs for the brain injured from coma to community;
(4) to provide a central clearinghouse for information and resources for the brain injured and their families; and
(5) to establish specialized brain injury rehabilitation programs.
Brain Injury Association
1608 Spring Hill Road
Suite 110
Vienna, VA 22182
703-761-0750
Fax: 703-761-0755
1-800-444-6443
www.biausa.org

Brain Injury Association of Pennsylvania, Inc.
2400 Park Drive
Harrisburg, PA 17110
717-657-3601
www.biapa.org

Brain Injury Association of Delaware, Inc.
32 West Loockerman Street
Suite 103
Dover, DE 19904
302-346-2083
1-800-411-0505
www.biausa.org/Delaware/bia.htm

Long Island Head Injury Association, Inc.
65 Austin Blvd.
Commmack, NY 11725
516-543-2245
www.lihia.org

Brain Injury Association of Maryland, Inc.
2200 Kernan Dr.
Baltimore, MD 21207
1-800-221-6443
Fax: 410-448-3541
www.biamd.org

Brain Injury Association of New Jersey, Inc.
825 King George Road
North Brunswick, NJ 08902
732-745-0200
www.bianj.org

Brain Injury Association of New York State, Inc.
10 Colvin Ave.
Albany, NY 12206
518-459-7911
1-800-228-8201
www.bianys.org
B. Functional Measurement Scales and Diagnostic Tests

Glasgow Coma Scale

The Glasgow Coma Scale is used to evaluate a person’s responsiveness during coma. The patient’s best responses in three areas – eye-opening response, motor response and verbal response – are scored on a scale of three to 15. The scale is used to help predict a person’s long-term progress and provides a basis for analyzing changes during coma. In general, this scale is used at the time of the traumatic injury and helps to ascertain the level of consciousness at the point in time it was administered.

<table>
<thead>
<tr>
<th>EYE OPENING (E)</th>
<th>VERBAL RESPONSE (V)</th>
<th>MOTOR RESPONSE (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 = Spontaneous</td>
<td>5 = Normal conversation</td>
<td>6 = Normal</td>
</tr>
<tr>
<td>3 = To voice</td>
<td>4 = Disoriented conversation</td>
<td>5 = Localizes to pain</td>
</tr>
<tr>
<td>2 = To pain</td>
<td>3 = Words, but not coherent</td>
<td>4 = Withdraws to pain</td>
</tr>
<tr>
<td>1 = None</td>
<td>2 = No words... only sounds</td>
<td>3 = Decorticate posture</td>
</tr>
<tr>
<td></td>
<td>1 = None</td>
<td>2 = Decerebrate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 = None</td>
</tr>
</tbody>
</table>

TOTAL = E+V+M
Disability Rating Scale (DRS)

The Disability Rating Scale (DRS) was developed and tested with older juvenile and adult individuals with moderate and severe traumatic brain injury (TBI) in an inpatient rehabilitation setting. The scale is intended to measure accurately general functional changes over the course of recovery.

One advantage of the DRS is its ability to track an individual from coma to community. The first three items of the DRS (“Eye Opening,” “Communication Ability” and “Motor Response”) are a slight modification of the Glasgow Coma Scale and reflect impairment ratings.

The DRS also rates level of cognitive ability for “Feeding,” “Toileting” and “Grooming.” The “Level of Functioning” item reflects handicap, as does the last item, “Employability.”

The maximum score a patient can obtain on the DRS is 29. A person without disability would score zero. The DRS must be obtained while the individual is not under the influence of anesthesia, other mind-altering drugs, recent seizure, or recovering from surgical anesthesia.

<table>
<thead>
<tr>
<th>AUDITORY FUNCTION SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 – Consistent Movement to Command</td>
</tr>
<tr>
<td>3 – Reproducible Movement to Command</td>
</tr>
<tr>
<td>2 – Localization to Sound</td>
</tr>
<tr>
<td>1 – Auditory Startle</td>
</tr>
<tr>
<td>0 – None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VISUAL FUNCTION SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 – Object Recognition</td>
</tr>
<tr>
<td>4 – Object Localization: Reaching</td>
</tr>
<tr>
<td>3 – Visual Pursuit</td>
</tr>
<tr>
<td>2 – Fixation</td>
</tr>
<tr>
<td>1 – Visual Startle</td>
</tr>
<tr>
<td>0 – None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MOTOR FUNCTION SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 – Functional Object Use</td>
</tr>
<tr>
<td>5 – Automatic Motor Response</td>
</tr>
<tr>
<td>4 – Object Manipulation</td>
</tr>
<tr>
<td>3 – Localization to Noxious Stimulation</td>
</tr>
<tr>
<td>2 – Flexion Withdrawal</td>
</tr>
<tr>
<td>1 – Abnormal Posturing</td>
</tr>
<tr>
<td>0 – None/Flaccid</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OROMOTOR/VERBAL FUNCTION SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 – Intelligible Verbalization</td>
</tr>
<tr>
<td>2 – Vocalization/Oral Movement</td>
</tr>
<tr>
<td>1 – Oral Reflexive Movement</td>
</tr>
<tr>
<td>0 – None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATION SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 – Oriented</td>
</tr>
<tr>
<td>2 – Functional: Accurate</td>
</tr>
<tr>
<td>1 – Non-Functional: Intentional</td>
</tr>
<tr>
<td>0 – None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AROUSAL SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 – Attention</td>
</tr>
<tr>
<td>2 – Eye Opening without Stimulation</td>
</tr>
<tr>
<td>1 – Eye Opening with Stimulation</td>
</tr>
<tr>
<td>0 – Unarousable</td>
</tr>
</tbody>
</table>

| TOTAL SCORE |
To Reach Bryn Mawr Rehab Hospital

**From Delaware and Points South:** Follow I-95 north to Exit 8 (202 north). Follow Rt. 202 north to Paoli Pike exit. Turn left at stop sign at bottom of exit ramp. Follow Paoli Pike 4 miles to BMRH on right.

**From Berks County and Points West:** Take PA Tpk. east to Exit 312 (Downingtown). Take Rt. 100 south to Rt. 30. Turn left onto Rt. 30 east and continue to Rt. 352. Turn right onto Rt. 352 south and continue to Paoli Pike. Turn left onto Paoli Pike. Proceed 2 miles to BMRH on right.

**From Northern NJ or New York City Area:** Follow NJ Turnpike to Exit 6 (PA Tpk.). Take PA Tpk. to Exit 326 (Valley Forge). Take Rt. 202 south to Rt. 252 south (Paoli). Follow to Rt. 30. Turn right onto Rt. 30 west. Follow to Paoli Pike (Matthews Ford dealership). Make soft left onto Paoli Pike and proceed 4 miles to BMRH on left.

**From Pocono Region:** Take PA Tpk. NE Extension south, then west to Exit 326 (Valley Forge). Take Rt. 202 south to Rt. 252 south (Paoli). Follow to Rt. 30. Turn right onto Rt. 30 west. Follow to Paoli Pike (Matthews Ford dealership). Make soft left onto Paoli Pike and proceed 4 miles to BMRH on left.

**From Phila. or Southern NJ:** Take Walt Whitman Bridge to Rt. 76 west (Schuykill Expressway). Exit at Rt. 202 south. Take Rt. 202 south to Rt. 252 south (Paoli). Follow to Rt. 30 west. Follow to Paoli Pike (Matthews Ford dealership). Make soft left onto Paoli Pike and proceed 4 miles to BMRH on left.

**From Philadelphia International Airport:** Take I-95 south to the Blue Route (Rt. 476 north). Take the Blue Route to Exit 9 (Upper Darby/Newtown Square) and make a left at the light onto Rt. 3 (West Chester Pike). Proceed west to Rt. 352 north and turn right. Continue to the 3rd light which is Paoli Pike. Turn right onto Paoli Pike and BMRH is 2 miles on the right.

**From Delaware County:** Take Rt. 1 or Rt. 3 to Rt. 352. Follow Rt. 352 north to Paoli Pike. Turn right onto Paoli Pike and proceed 2 miles to BMRH on right.