CHAPTER FIVE

MEDICAL MATTERS

Climb if you will, but remember that courage and strength are naught without prudence and that momentary negligence may destroy the happiness of a life time.
Do nothing in haste, look well to each step, and from the beginning think what may be the end
(Edward Whymper)

'If you are bored with life, risk it'. So says the cynic. We are not bored, at least not with life and are not going to risk life and limb in a foolish way ~ are we?!! I have heard arguments which effectively say that any unnecessary risk is foolish, not least because it may risk the lives of rescuers. This has to be a fatuous argument and I choose to ignore it. On the other hand there can be no excuse for the kayaker who heads over the horizon, ill clad, ill informed and ill-equipped and then uses his radio or (even worse) mobile telephone, to summon help when he meets trouble. Sea kayaking remains safe because we have traditionally taken the time to learn and gain experience before undertaking any serious adventure. All adventures have to contain an element of risk if they are to be adventurous and this is why this chapter exists.

I want to look at the sort of accident that may come from sea kayaking and also say a brief word or two about illnesses you may have to deal with in wilderness areas. I can lay claim to having a little personal knowledge as I have spent most of my career as a Health Care officer in the Prison Medical Service and have provided the medical/first aid input into several fairly large kayaking expeditions.

I have to tell you that in all the years I have been canoeing, I have rarely had to use my First Aid Kit that I so religiously maintain and carry around with me. It seems to me that most medical emergencies can be provisioned for by improvising with a whole range of items that are normally around you. Having said this I am convinced that the day I fail to carry my First Aid Kit will be the day I really need it.

First Aid is just as much a matter of knowing what you should not do as it is to know what you should do. Often well meaning intervention is simply not warranted over and above making comfortable and re-assuring.

Good Expedition Medicine is about prevention, which as we all know is better than ' the cure '.

First though, some basic first aid that I believe is incumbent on us all to understand and be able to apply whether we are kayaking or walking down the high street.

If leading an expedition or even if you are part of an expedition into the wilderness then you should at least know some of the rudiments. Let us look at the sequence of events and the steps to take on dealing with any medical condition when professional medical care is only a 999 call away, and this includes most of the U.K. coastline. If the patient is suffering acutely from signs (what you see) and symptoms (what the patient feels or complains of) that obviously need attention but are not immediately life threatening then assess and prioritise before rushing in. Make comfortable, plenty of re-assurance, keep protected and administer nothing, least of all pain relievers. Your main purpose is to ensure rapid medical evacuation by the most appropriate means, be it ambulance or inshore life boat.

If, on the other hand the patient is suffering from the results of an accident, the effects of which are obvious - except of course you cannot usually diagnose internal injuries like punctured organs or fractured bones - then you have four priorities :-

(1) Ensure breathing

(2) Ensure heartbeat

3) Control bleeding

(4) Ensure no further damage

I will take these one at a time.
Before I do you have a duty to ensure the second accident victim is not going to be you. Consequently your first priority is to make sure that before you rush into render assistance the situation is safe. Is the rest of the wall going to fall on you? Is the electric current still surging? Is the gas still contaminating the air? There is no point in taking a long swim in freezing water to reach a fellow paddler if you truly assess the risk is unacceptable. Heroics is one thing, crass stupidity is another.

So back to number one on our list:-

(1) Ensure Breathing

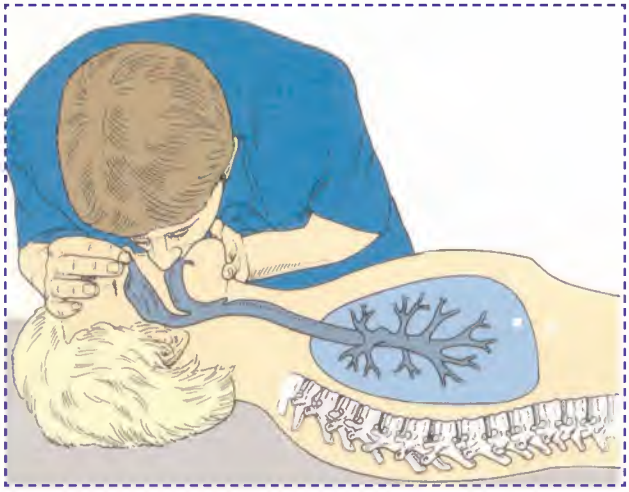
(i) First check that the patient is in fact breathing or not. Get down and look for the chest rising/falling and feel for any breath against your cheek.

(ii) If breathing has ceased then extend the neck to provide a clear airway by gently pushing the chin back.

(iii) Now we apply E.A.R. - or Expired Air Resuscitation, also known as Mouth to Mouth Ventilation.

* Elevating the chin with one hand and close his nose between thumb and forefinger of the other hand.

* Make a seal between his mouth and yours. Breathe in through your nose and then gently but firmly blow into the patients' lungs. Watch the chest rise.



* Remove your mouth to allow the weight of the patient's lungs to expel the air you have just blown in.

* Repeat this twice before checking for a heart beat.

* For a child put your mouth over mouth and nose and breathe in a little faster.

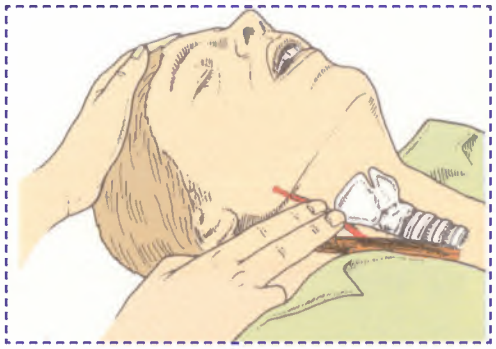
* Beware of the patient vomiting as he/she starts to recover; turn the patient onto his side to allow drainage and prevent choking.

* If the heart is beating and a pulse is felt - continue to give inflations at a rate of 12-16 times per minute until natural breathing is restored, when the casualty is then placed in the Recovery Position

(2) Ensure Heartbeat

(i) It is pointless continuing artificial ventilation if the casualty's' heart is not beating, because the oxygenated blood will not be circulating. After the first two ventilations you must check to ensure the heart is beating. Whilst it is in order to assist by artificial ventilation, breathing which is failing, the heart action is easily upset. Consequently never attempt External Chest Compression if the heart is beating, even faintly and any pulse is felt.

(ii) A reliable way of establishing a lack of circulation is to check the pulse at the neck (carotid pulse). Place your finger tips gently on the voice box and slide them down into the hollow between the voice box and the adjoining muscle. (The pulse of the wrist is unreliable). You must check again after the first minute and then every three minutes. It will only return when the heart recommences beating.



(iii) Once you are sure there is no heart beat, you need to commence EXTERNAL CHEST COMPRESSION :~

* Lay casualty on his/her back - on a firm surface.

* Kneel alongside him facing his chest.

* Find the point over which you need to apply compression by locating the lower end of the breast bone. Come up the breast bone by two finger breadth, and here place the heel of one hand.

* Cover this hand with the heel of your other hand and interlock your fingers to ensure you keep the fingers of your lower hand up and off the rib cage.

* Now start compressions by keeping your arms straight and vertical over the casualty's' chest and pushing down by about 4-5 cms (1 to 2 inches) for the average adult.

* Complete 15 compresses at the rate of 80 per minute. Your compressions should be regular and smooth and to help maintain the correct rate count one and two and threee and so on.

* After 15 compressions, return to the casualty's' head. As before, extend the neck to ensure a clear air way to the lungs and give two breaths of mouth to mouth ventilation.

* Return to the chest and continue with 15 more compressions.

* After the first minute check the carotid pulse for heart beat. Thereafter check every three minutes.

* As soon as the pulse returns stop the compressions and continue with mouth to mouth ventilation until natural breathing is restored.

* Once heart beat and breathing is restored, the patient needs to be placed in the RECOVERY POSITION.

WITH TWO FIRST AIDERS one should take charge of breathing, the other of chest compressions.

* The one at the head gives two inflations and checks the carotid pulse for heart beat.

* If absent, the other First Aider begins chest compressions.

* Resuscitation then continues with the First Aider at the head giving a single inflation on the upstroke of every fifth compression as applied by the partner. Compressions are continued at the rate of 80 per minute until the circulation is returned. As before the pulse check is carried out after the first minute and then every three minutes.

The Recovery Position ensures an open airway and allows vomit to drain freely from the casualty's' mouth. It may not be an ideal position to allow the best possible further examination for injuries, however it must be used immediately if unconsciousness prevails or you have to leave the casualty to fetch assistance.

* Kneeling by the casualty, turn his head towards you and keeping the chin back to ensure a free airway.

* Place the casualty's' arm nearest to you by his side and tuck his hand just beneath his buttock.

* Holding the far leg under the knee bring it over the near leg.

* Bring his other arm across his check.

* Protecting the head reach over and pull the hip furthest from you towards you.

* Bend uppermost arm at right angles to support the upper body.

* Bend uppermost knee to form a right angle at the knee joint to bring the thigh well forward to support the lower body.

* Pull the other arm out from under the body.

* Check this position is stable and that no more than half his chest is in contact with the ground and that his head remains tilted with jaw forward to maintain an open airway.

(3) Control Bleeding

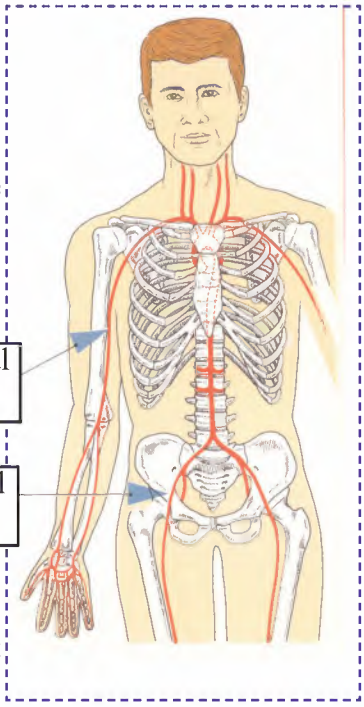
Bleeding often looks dramatic whilst in itself not necessarily being life threatening. There are two ways of stopping bleeding - PRESSURE and ELEVATION. There are two types of pressure - direct or indirect. Always try direct pressure first:-

(i) Elevate the injured limb if possible.

(ii) Add more pads and bandages if the bleeding continues.

(iii) Indirect pressure may be applied to control arterial bleeding from a limb. Here pressure is applied to recognised points on the body known as pressure points. These are points where you can compress an artery against an underlying bone in order to obstruct it and slow down or stop blood flowing through it. However, since this method also cuts off the supply of blood to the rest of the limb, such a technique should be used as a last resort and then for not longer than 15 minutes.

There are two pressure points used to control severe bleeding, one is on the brachial artery in the arm and the other is on the femoral artery in the groin.



4) Ensure No Further Damage

This is the final of our four priorities. Once the patient is in the Recovery Position and breathing satisfactorily and is not bleeding you can pause and work out your next move. Obviously any strategy depends very much on the circumstances you are in at the time.

If you are in reach of assistance then you will summon it and the problem is then passed on. On the other hand you may well have to work out your own destiny.

Sea paddlers continue to search out remote parts of the world in which to undertake their expedition and a serious injury well away from civilisation will probably make extreme demands on those dealing with it.

Once you have decided that medical evacuation is either not indicated or not feasible, then you have to rely on the casualty to make a sufficient recovery so that he or she can continue on the expedition, or at least move out and return to where further medical attention is available.

There is little point in me discussing possible scenarios as common-sense will dictate the course of action. Apart from which there are several books on the subject of wilderness survival. One of the best is the Royal Geographical Society's publication, "EXPEDITION MEDICINE". These books will discuss a series of priorities such as protection, shelter, food and water, route finding, fire making, etc. in terms of survival techniques that are important once an expedition gets into bother in truly remote and wild areas. There are also specialised wilderness first aid courses; just check out the world wide web. Whether these areas are hot or cold climates will have a tremendous bearing on your actions and decisions and I will be covering hypothermia (suffering from cold) and hyperthermia shortly.

Whilst kayaking in remote places, I often ponder on the 'what ifs'. What if an accident occurs, what if the weather suddenly deteriorates, what if someone becomes ill. Such thinking and consideration of contingencies is especially important when you are looking after or leading a group on an expedition. Look for escape routes; keep an eye on local weather patterns and on the movement of the sea. Situations

and possibilities are changing all the time; just make sure you remain aware of them.

To remain safe there is a need for an escape route. Where is the nearest track out, where is the nearest village or house, where is the nearest telephone. Being stuck in the middle of nowhere, with no readily available escape route, may mean you have to see the casualty through the immediate injury and through to a recovery where taking an escape route becomes possible even if it means having to provide the casualty with support in the form of a stretcher party or a tow in a kayak.

Watch out for your fellow paddlers. Try and identify the weakest paddler - which may be you of course - and keep a special eye on him/her when conditions deteriorate. Some years ago, paddling along a remote stretch of the north Norwegian coast looking for a suitable camp site late in the day, I noticed one of the group slowing down and becoming distressed. I determined to return to a site we passed earlier as the wind and sea would now assist and of course I knew with certainty that it was there. This proved to be a decision taken just in time as we had a bad case of exposure to deal with. It can be a little like 'Russian roulette' in that there might have been an ideal site for camping just around the next head land ……. But then can you risk it?

Ensuring no further damage leads us neatly into my next section on 'Medical Matters' , that is GENERAL MEDICAL MANAGEMENT, a management you will have to undertake once the patients' life is out of immediate danger from asphyxiation and blood loss.

GENERAL MEDICAL MANAGEMENT

SHOCK.
Shock is defined as a lack of tissue perfusion -basically, not enough blood is reaching the body's tissues. If shock is untreated, these tissues will rapidly die, causing irreversible organ failure.

CAUSES OF SHOCK
Blood loss -trauma or bleeding into gut
Dehydration
Infection -septic shock
Anaphylaxis .Heart failure
Spinal injury -neurogenic shock.

SIGNS OF SHOCK
Rapid heart rate
Rapid respiratory rate
Weak pulse and low blood pressure
Pallor
Reduced urine output.
In young people, almost 50% of the circulating blood volume must be lost before the blood pressure falls. This, therefore, is a late sign of shock.

MANAGEMENT OF SHOCK
Maintain airway and provide oxygen
Ensure casualty is lying down with legs raised
Treat external bleeding with pressure and elevation
Straighten and splint fractures
Consider intravenous fluids.

The treatment for shock due to continuing blood loss is a surgical operation to stop the bleeding. Administration of intravenous fluids is a temporary measure only. Rapid evacuation is essential for shocked patients.

So there are two causes. First there is failing blood pressure and second there is a reduction of the volume of blood in the body. The reasons for either of these states can be due to a variety of injuries such as bleeding, vomiting, acute abdominal emergency such as peritonitis.

The aim is to improve blood supply to the brain, heart and lungs. This is achieved by external chest compression, stopping bleeding, and mouth to mouth resuscitation, and placing in recovery position as per our priorities. Our attention to shock 'per se' is normally applied to a conscious patient. Here the management consists of making the patient comfortable and providing plenty of re-assurance. Do not provide anything by mouth unless the longer term management becomes your responsibility. Obviously then you are going to have to consider warm sweet drinks and even analgesics (pain killers).

Shock and collapse after an accident when obvious bleeding is only slight, might suggest internal damage. Clues may consist of the coughing or vomiting of blood, the passing of blood from any of the other body orifices such as nose, ears, back passage. The patient may well complain of worsening abdominal pain and the abdomen may become distended and painful to the touch. Here you need to treat as for shock and arrange for immediate medical evacuation or support.

OPEN WOUNDS AND INFECTION.
Having controlled the bleeding and treated, if necessary for shock, you need to clean and dress the wound. First remove any visible foreign bodies, sprinkle with antibiotic powder and cover with a field dressing. If you have no sterile dressing available then improvise using whatever suitable materials that comes to hand such as a clean handkerchief, towel or neckerchief. Do not use any fibrous or woolly material directly on a wound; the fibres can become embedded in it.

Improvised dressings should be covered and held in position using other materials as available such as items of clothing, towels, etc. If the foreign body stuck in a wound is firmly embedded and medical aid is not too far away, then simply build up a pad around the foreign body before bandaging around the wound.

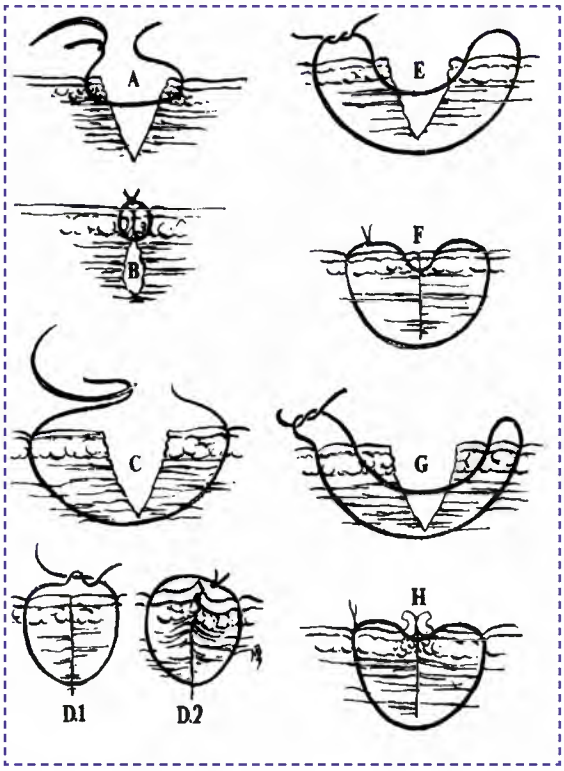
It may be necessary to go beyond first aid measures by considering the need to suture the wound. Maybe STERISTRIPS may be sufficient. These are thin sticky strips which are secured to one side of the wound and, with the wound pressed closed, are stuck down to the other side. When applying start at the middle of the wound and work out to either side. These should remain in place until healing has occurred.

The problem with these Steristrips is that they may not provide a sufficiently secure hold over the wound, particularly if they get wet. You may well have to consider suturing and if proper medical aid is not available you are going to have to suture. The problem for the First Aider is that this technique is unpracticed.

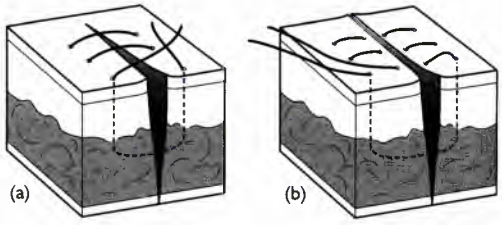
The aim of suturing a wound is to replace all damaged tissue from the bottom of the wound to the surface in firm apposition and careful alignment. You need clean instruments, clean hands and a clean wound. It is often necessary to shave the area of the wound. There are two aphorisms :-

(1) If in doubt as to whether there are sufficient sutures - there are not.
(2) If in doubt as to whether the suture is wide or deep enough - then it is not.

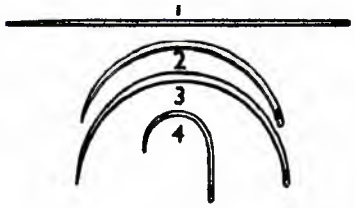
I have sutured wounds 'in the field' and when the suturing follows soon after the injury there is little discomfort suffered by the patient. Before providing yourself with a suture pack to supplement your first aid kit, find a friendly Casualty Officer at your local hospital and watch and learn. You will need to convince the doctor of your purpose as normally suturing is a medical procedure normally undertaken by a doctor. You will need advice on which type of suture needle and thread to take and on which instruments to use.



(A) Superficial suturing designed to get careful apposition of skin
(B) Deep cavity left by the superficial sutures - such wounds tend to break down
(C) The deep wide suture designed to give full apposition of skin and deep tissue
(D1) All tissue in firm apposition
(D2) Overlap of the skin edges when the sutures are too tight
(E) A combination of deep and superficial sutures
(F) The resultant careful closure of all tissue
(G & H) Showing how the skin edges are everted if the superficial component of this mattress suture is placed too far from the edges of the wound.



(a) ordinary sutures
(b) eversion suturing



1. Straight. 2. Half circle
3. Three-eighth circle
4. 'J' shaped

INFECTIONS.
The casualty who escapes death from bleeding, asphyxia and shock still faces one further danger to life - infection. Certain fatal infections can be guarded against by immunisation, and one of these is tetanus; any person likely to be injured should be immunised against tetanus, especially as tetanus can originate in seemingly trivial wounds

What is tetanus?

Tetanus, commonly called lockjaw, is a bacterial disease that affects the nervous system. It is contracted through a cut or wound that becomes contaminated with tetanus bacteria. The bacteria can get in through even a tiny pinprick or scratch, but deep puncture wounds or cuts like those made by nails or knives are especially susceptible to infection with tetanus. Tetanus bacteria are present worldwide and are commonly found in soil, dust and manure. Infection with tetanus causes severe muscle spasms, leading to "locking" of the jaw so the patient cannot open his/her mouth or swallow, and may even lead to death by suffocation. Tetanus is not transmitted from person to person.

Prevention

Vaccination is the best way to protect against tetanus. Due to widespread immunisation, tetanus is now a rare disease in the west. A combination shot, called the Td vaccine, protects against both tetanus and diphtheria. A Td booster shot is recommended every 10 years. Adults who have never received immunisation against tetanus should start with a 3-dose primary series given over 7-12 months.

Symptoms

Common first signs of tetanus are a headache and muscular stiffness in the jaw (lockjaw) followed by stiffness of the neck, difficulty in swallowing, rigidity of abdominal muscles, spasms, sweating and fever. Symptoms usually begin 8 days after the infection, but may range in onset from 3 days to 3 weeks.

Who should get Td vaccine?

* All adults who have not had a Td booster shot in the last 10 years.
* Adults who have recovered from tetanus (lockjaw) disease.
* Adults who have never received immunisation against tetanus.

Vaccine Safety

Tetanus vaccine and the combination Td vaccine are very safe and effective. When side effects do occur, they usually include soreness, redness or swelling at the injection site and a slight fever. As with any medicine, there are very small risks that serious problems, such as an allergic reaction or neurologic condition, could occur after getting a vaccine. However, the potential risks associated with tetanus disease are much greater than the potential risks associated with the tetanus vaccine. You cannot get tetanus from the vaccine.

Unfortunately active immunity against many other dangerous infecting organisms cannot be so readily provided. In extensive or dirty wounds the only effective method of preventing infection is early adequate surgical excision of the wound and this should be done within 6 hours of the wound occurring.

Onset of infection can be delayed by giving antibiotics and by splinting the wound whilst ensuring that the surrounding area is not constricted or compressed and that the wound is left open to allow drainage of serum. A large, loose absorbent dressing should be lightly applied so that the discharging wound is absorbed and the surface kept as dry as possible.

Fortunately the infecting organisms most feared in wounds are nearly all sensitive to penicillin and oral penicillin should be given as soon as possible after the injury. These measures taken to prevent death from the effects of injury will seldom be necessary as most injuries are not that severe as to endanger life.

PROTECTION BY VACCINATION.

Although the value of vaccination is often disputed because of the varying effects it has on different individuals, there is no doubt that most vaccines are highly effective and the difference in attack rates between protected and unprotected groups exposed to the small risk of disease is extremely rare. A few vaccines are less effective but, even with these, a vaccinated individual who becomes infected will usually suffer only a mild attack. Another criticism is the risk of serious reaction to the vaccination. The dangers of this are very small and can, to all intents and purposes be discounted, particularly for those adventuring to remote areas where medical aid and facilities are lacking.

Depending on where you are travelling the following diseases for which protective vaccines are available are:-

1 Yellow Fever
2 Cholera
3 Diphtheria
4 Tetanus
5 Tuberculosis
6 Poliomyelitis
7 Enteric Fever (typhoid and paratyphoid fevers)
8 Plague
9 Rabies

The first two diseases are those for which an INTERNATIONAL CERTIFICATE OF VACCINATION may be required and some countries do insist on this Certificate before allowing entry.

The requirement of various countries are complex and you will need to check with a good tourist company of the embassy of the country concerned. The diseases (3) to (6) are those against which vaccination is commonly practiced in Britain and elsewhere, particularly among children. All are diseases that may be prevalent in certain areas of the world, especially where sanitary conditions are poor. This is also true of Enteric Fever (7) though routine vaccinations against this disease are unusual beyond the armed services.

Plague and Epidemic Typhus (8) and (9) are diseases that usually occur in reasonably well defined epidemics. Special facilities exist for making an outbreak of one of these diseases made known to Health Authorities throughout the world and consequently it is unusual to vaccinate against them unless the need is obvious.

When more than one vaccine needs to be given, certain restrictions on the timing of the various procedures have to be observed. For example there needs to be an interval of 3 weeks between vaccination against Tuberculosis and vaccination against Smallpox or Yellow Fever. The arm injected when vaccinating against Tuberculosis should not be used for any other vaccinations for 3 months. If the Yellow Fever and Smallpox inoculations are both required. Yellow Fever vaccine should be given first with the Smallpox vaccine not less than 4 days later.

The planning of a complete course of vaccinations is complicated and will depend on the countries to be visited and whether any previous vaccinations have been given. A complex course cannot be condensed into less than 2 months and it is better immunologically as well as for the comfort of the traveller to have the various procedures spread over a longer period..
When any strenuous training for an expedition is intended you should understand that. vaccinations may well interfere with this and plan accordingly.

It will be clear that hard and fast rules cannot be laid down and you should consult with and take advice from your doctor in the early stages of your planning.

FRACTURES
CLASSIFICATION OF FRACTURES.
Broken bones present in various ways and with varying degrees of severity; many works on first aid go into great detail in discussing the different classifications of fractures.

For practical purposes, however, fractures may be divided into:-
(a) Open - the wound communicates with the fractured ends of the bone. (Compound)
(b) Closed - the skin over the fracture is intact.

Fractures can further be divided into:-
(a) Stable - the fractured ends are sufficiently supported to prevent too much movement.
(b) Unstable ~ the fractured ends move in relation to each other.

A further classification is important :-
Complicated - where serious injury to other tissues or organs co-exists. In a complicated fracture treatment of the associated injury takes priority.

SIGNS OF A FRACTURE are:-
(a) Deformity such as angulation of the bone or shortening due to over-riding of the fragments.
(b) Irregularity of the bone outline.
(c) Grating of the bone ends (known as crepitus) - do not go looking for this sign!!
(d) Unnatural mobility when movement at the site of the fracture is noted. - again do not go looking for this sign these last two signs may be observed when handling the patient.
(e) Pain.
(f) Swelling.
(g) Loss of power in the affected limb.

TREATMENT OF FRACTURES.
Open fractures are serious injuries and any resulting infection could well be life threatening.

In dealing with closed unstable fractures, the objectives are to reduce the deformity, immobilise the fractured ends until union takes place and to support the fracture until the union is consolidated and the fracture is healed.

In stable fractures without displacement all that is required is to support the fracture until union is consolidated. Failure to appreciate this often leads to too much unnecessary splintage and immobilisation.

Let us look at some specific treatments for specific fractures.

(a) SKULL
Fracture of the skull is important because of the associated brain injury. If the fracture is open the wound must be dressed, antibiotics administered and transport to hospital arranged immediately. Fortunately head-injuries "travel' well as a rule. Occasionally it is possible to observe that a part of the skull is actually depressed, causing a groove or pond-like depression in the skull. Since this will inevitably lead to compression of the brain, the patient requires surgical treatment and should be evacuated with a note that the depression was observed, since this may subsequently fill with blood and become less noticeable. Leakage of fluid from nose or ear may be a sign of skull fracture/

(b) SPINE
Most of us know that fracture of the spine may cause injury to the spinal cord resulting in paralysis below the level of the fracture.

If after an injury the patient cannot move his limbs, it is important to first determine whether sensation has been lost by pinching the skin. If sensation is present, then it is likely that the inability to move is due to local injury of the limb. If, on the other hand, sensation is absent, injury to the spinal cord has to be assumed. In fact, it is usually best to assume spinal injury until proven otherwise.

In all cases, great care must be taken to ensure the spine is not bent. If you really must move the casualty then do everything possible to avoid movement of the spine.

(c) PELVIS

In fractures of the pelvis, the main complication to be feared is injury to the bladder or the urethra (the tube leading from the bladder to the outside). Patients with this injury usually cannot move their legs or have difficulty in doing so. Sensation is unaffected.

The appearance of a few drops of blood from the urethra is of grave significance, indicating injury or rupture. Injury to the bladder is not so obvious, but is serious being often accompanied by severe internal bleeding and shock.

If evacuation within 12 to 20 hours is possible, the patient should be warned to not pass water if at all possible. If the patient feels he is passing water and yet no passage of urine is observed, then it is fairly certain that rupture of the bladder has occurred and without surgery the prognosis is bleak. There will normally be acute abdominal pain. Apart from this complication a fractured pelvis requires that the patient remains as still as possible during removal to hospital.

(d) LIMBS

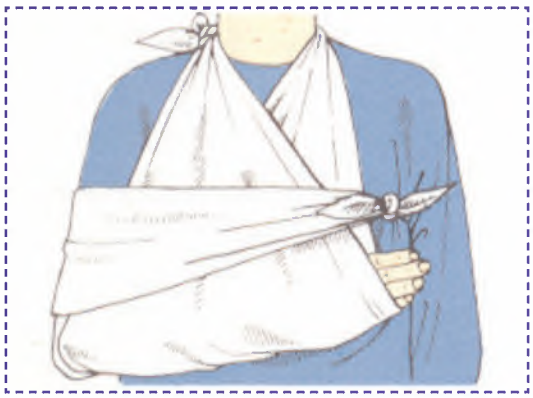
In limb injuries, the complication of fractures is associated injury to blood vessels. The circulation in the limb beyond the fracture should be checked by pressure on a nail and observing if the colour returns. If the colour fails to return rapidly, then interference with the blood circulation is to be assumed. This may be due to pressure on a blood vessel which may be relieved by gently adjusting the limb to align it with the uninjured limb. Any constrictive bandage should be removed. If these measures restore the circulation, then proceed with splinting as described below.

Should the circulation be absent, it must be assumed that the main vessels are injured and gangrene is imminent. The greatest chance for recovery from such a condition is surgical intervention, within four hours. If this is not possible, it is best to keep the patient recumbent with the affected limb as cool as possible and kept level with the body. If no signs of recovery are observed, such as the return of colour beneath the nails, or if a greenish-black discolouration appears beneath the skin below the fracture, then gangrene has to be assumed and a tourniquet applied very tightly just above the fracture site or at the lowest limit of normal sensation whichever is higher up the limb. This is done because amputation is inevitable and it is best to limit the spread of infection and absorption of toxic breakdown products from the dead limb. Once applied such a tourniquet must not be removed.

When dealing with uncomplicated fractures, upper limb fractures are best put in a sling. If further stability is required, bandaging the arm to the patient's side with suitable padding to ensure comfort is advised. The pulse should be felt at the wrist to ensure there is no constriction of the blood vessels due to over-bending of the elbow or too light a bandage.

Splints for the upper arm serve no useful purpose and merely aggravate deformity and constriction.

Fractures of the forearm are often reasonably comfortable when treated with a sling. If unable, they may require a well padded splint along the back of the arm, care being taken to avoid constriction. The fingers should not be bandaged to the splint but allowed freedom to move.



Fractures of the wrist and hand are usually stable and only a sling is required. A fractured finger should be fixed to an adjoining finger with short lengths of sticky plaster.

Fracture of the thigh is always serious as considerable blood is lost to the surrounding tissues and some degree of shock is usual. By far the best splint is the THOMAS KNEE SPLINT but as this is unlikely to be

available, an improvised splint must be used. The limbs should be bandaged together, the injured leg being straightened by drawing the ankle gently and firmly downward exerting a strong and steady pull while the legs and thighs are being bandaged together with plenty of padding between the thighs and knees. Once this is achieved any suitable splint such as a paddle that will reach from the armpit to the ankle is bandaged to the body and legs.

Fractures around the ankle are usually stable. If the displacement is gross or if the circulation of the foot is impaired, then the fracture must be reduced by holding the foot firmly - pulling strongly and first increasing the angular deformity before slowly swinging the foot into place. This is best achieved by having the leg handing down over the edge of a flat surface like a ledge or rock. Ankle and foot fractures are most comfortable in a wool and firm bandage or even better, SAM splints.

SPRAINS AND DISLOCATIONS.

If a joint is simply stretched beyond its normal limit with resulting pain, it is sprained. If this stretching results in displacement of a bone the joint is dislocated. Often a sprain is a self-reducing dislocation.

If the dislocation is obvious - and it usually is - and medical aid is unavailable, then an attempt at reduction of the dislocation should be made as soon after the injury as possible when the slight risks are more than outweighed by the rapid return of function. I have lost count of the number of dislocated fingers I have reduced, during a rugby game. Reducing a dislocated shoulder is not quite so easy. The essential of reduction without anaesthesia is to obtain the co-operation of the patient who must relax and allow a strong pull on the limb until the dislocated bone can be gently manoeuvred back into place. After reduction the injury must be treated as a sprain. For a dislocated shoulder reduction is achieved by a strong continuous pull on the arm with the forearm bent. While the pulling is maintained the forearm is slowly taken away from the patients' body, then the elbow is pulled forward and the forearm is swung around so that the patients' thumb touches his forehead.

Sprains of the wrist, elbow, knee or ankle are best treated by applying a wool and firm bandage dressing. First a layer of cotton wool is placed around the affected joint and bandaged firmly in place, then another layer of wool is placed around the joint extending almost halfway to the joints above and below and bandaged with even more firmness. A third layer of wool is applied and is bandaged even firmer still. Ensure the bandaging does not interfere with circulation.

MINOR CASUALTIES.

Minor cuts and abrasions are best cleaned well with soap and water and allowed to dry. A dry gauze none-stick (Melolin) dressing may then be applied if protection from flies and insects, or from chafing by clothing is requried.

Infected cuts, grazes or insect bites require a dressing to afford protection from pressure and flies. For such injuries a dressing moist with a strong salt solution forms a hygroscopic application that encourages free drainage, inhibits bacterial growth and deters insects. To prepare the salt solution dissolve as much as possible in boiled water that has been allowed to cool, wring out a piece of gauze in the solution and use this as a bandage on the wound. This dressing should be changed before it dries out. Having advised on this type of dressing it has to be said there are now much better dressing packs available.

EYE INJURIES.

All eye injuries are potentially serious. The eye can be cut or bruised by direct injury such as a blow, broken spectacles, or flying fragments of anything sharp. The aim of the first aider is to prevent any unnecessary deterioration by preventing movement and seeking medical attention. Certainly, do not put ointment or drops into an injured eye unless you are sure of this being the right treatment and do not attempt to remove foreign bodies that have become embedded in the eye itself.

Basically an eye pad is bandaged into position over the injured eye. Particles of dust or grit or loose eye-lashes are the most common foreign bodies affecting the eye and these stick to the outer surface of the eye-lid, normally the upper lid, causing considerable pain. In treating this, have the patient look down while you gently grasp the eyelashes and pull the upper lid out and upwards over a match stick to allow examination. The grit or dust is removed by using a moistened swab or the damp corner of a clean handkerchief.

BURNS AND SCALDS.

Burns vary in depth, size and severity and may damage the underlying parts of the body as well as the skin. Most burns will require medical attention as there is considerable risk of infection. There is also a danger of shock developing as the tissue fluid leaks out of the circulatory system into the burnt area.
Burns are classified according to the area and depth of injury and these two factors determine what treatment is required. The area of a burn gives a rough guide as to whether the casualty is likely to suffer shock.

General treatment consists of : -

(i) Immerse injured part in cold water for 10 to 15 minutes.
(ii) Remove any loose unstuck clothing and shoes.
(iii) Cover with clean dressing. If skin is broken use sterile non-stick dressings.
(iv) Immobilise the limb.
(v) Give pain relievers.
(vi) Give frequent sips of water - increasing if patient will tolerate.
(vii) Do not prick blisters or apply ointments to severe burns.
(viii) Commence a course of antibiotics if medical aid is not forthcoming.

SUNBURN.

Direct exposure to the suns' rays may produce redness, itching and tenderness of the skin. It can vary from superficial burning to a more severe reaction in which the affected skin becomes lobster-red, blistered and painful. Over exposure to the suns' rays when it is very windy or the skin is wet with sea water can result in quite serious burns. However, sunburn can also occur even on a dull overcast day in summer due to presence of ultra-violet light.

Particular precautions are now required in the southern hemisphere. I was recently kayaking off the southern Chile coast and had arrived out there with very short notice and was not as well informed as I should have been (guess I should have been aware in any case) and took no precautions and was severely burnt on the back of my hands. Fortunately I always wear a wide brimmed hat otherwise I would have been in more serious trouble.

The treatment for sunburn is obvious enough. Place the casualty in the shade and sponge down with cold water. Give sips of cold water at frequent intervals. If there is extensive blistering medical aid should be sought. Pain relievers can be given and if the skin is unbroken, calamine lotion can be applied.

It goes without saying that prevention is better than cure, and the many proprietary lotions or creams, - most of which contain paramino benzoic acid - offer reasonable protection. A peaked baseball cap and a neckerchief prevent burning of the neck and face. The temptation to paddle whilst stripped to the waist is something you should resist unless you do so for short periods only.

SEA SICKNESS.

This is basically an inner ear disturbance resulting from the motion of the kayak on the water but it is dependent on such factors as time at sea and previous experience. It is aggravated by fear, anxiety, tiredness and boredom. Although many tests have been carried out there is no outstanding superior remedy and individuals vary as to what works with them. You need to experiment with the various tablets until you

discover one which provides maximum protection with minimal side effects. All will cause drowsiness and a dry mouth to some extent. It usually helps to take a tablet some hours before setting off and it may be enough to carry you through the period of adjustment so that you need no more tablets.
If more tablets are required take them on a regular basis before you feel ill, preferably about two or three times each 24 hours. Try to avoid very acid or spicy foods and never mix alcohol and sea-sickness tablets. It is equally important to avoid hunger so if you start feeling queasy take small amounts of food and fluid fairly frequently. Anyone vomiting continuously should be made to rest, encouraged to drink small amounts frequently, and to take sugar rich foods. Persistent vomiting over long periods may produce severe dehydration.
The following is a selection of available tablets:-
DRAMAMINE - (dimenhydrinate)
AVOMINE - (promethasine theodate)
MARZINE - (cyclizine)
STUGERON - (chinarizine)
KWELLS - (hyoscine)

POISONING.
Once in the body poisons act in various ways. Once in the bloodstream some poisons work on the central nervous system, preventing breathing, heart action and other vital functions. Other poisons act by displacing the oxygen in the blood and preventing its distribution to the tissues. Swallowed poisons also react directly on the food passages resulting in vomiting, pain and often diarrhoea.

The source of poison is usually fairly obvious. It may be poisonous plants. Laburnum, deadly nightshade and death cap fungus are the more common examples of plants which can poison the system. Another obvious cause of poisoning whilst underway on a kayak expedition is food poisoning. Some of the cooking I have endured over the years at camp sites causes me to wonder at the body's' constitution! The most common bacteria which multiply in food is STAPHYLOCCI and in so doing produces a toxin. Another one is SALMONELLAE which multiply in the bowel and cause dysentery- like illness. Salmonellae is infectious and can be passed through poor personal and kitchen hygiene. The signs and symptoms of poisoning depend upon the type of poisoning. Food poisoning appears a few hours after ingestion and is demonstrated by a fever (particularly in Salmonellae poisoning), diarrhoea, vomiting and abdominal pains. The patient may go into shock if the poisoning is severe. When considering treatment, do not attempt to make the patient vomit. Rest, comfort and re-assure and provide sweet drinks.

GIARDIASIS is a form of poisoning in that it is an infection caused by the ingestion of contaminated water and, though not a problem in the U.K., is certainly so in mountainous areas of American West. Paddlers and hikers should be particularly aware in the Rockies, Cascades a.nd Sierra. Europe and Asian mountains waters have long been a giardia haven. The disease is contracted by drinking water that has been faecally contaminated by mammals carrying the protozoa. The popular name, 'Beaver-Fever' stems from the diseases traditional attribution to the beaver or muskrat. However, deer, bear and wolf droppings also contribute to the problem.

The travelling form of the parasite is a cyst and only a few when ingested and lodged in the small intestine develop into active protozoa and then reproduce like mad. The period between ingestion and development of the symptoms can be between one and three weeks.

Although not fatal, once you suffer from it you will wish it was. Sudden diarrhoea, weakness, cramps, nausea, stomach pains, vomiting, fever characterise Giardiasis, and the acute phase can last up to a couple of months. Once contracted seek full medical aid. The most effective treatment seems to be ATABRINE (Metronidaza Tindazol) tablets. Prevention of the disease is achieved by ensuring you drink good water in the areas of the world where this disease is prevalent. Boiling the water for a full minute is said to be the answer. The effectiveness of chemical purification on Giardiasis cysts has been the subject of much debate.

Certainly only fresh chemical compounds such as chlorine, saturated iodine or other commercial products stand a chance of being effective. There are also a number of commercially available mechanical filters but the filtering medium has to be fine enough to take out the Giardici cyst. Giardiasis is an intensely unpleasant affliction but it is preventable. Not only can you treat your water, but by following good field sanitation procedures you can help reduce the threat to others.

TOOTHACHE.

Frequent causes of toothache are decay and in the middle of an expedition in a remote area is no place for such decay to start causing pain. Obviously, a visit to the dentist several months prior to departure is the answer. Several months gives the dentist time to complete all necessary work on your teeth. If you are a regular visitor to your dentist usually a final check prior to leaving will suffice.

In the event of toothache and a hole in the offending tooth is visible insert some cotton wool soaked in oil of cloves. Analgesics are certainly useful as are hot or cold mouth rinses - whichever gives most relief. If infection is suspected because swelling and redness is present with the pain then antibiotics are called for. You should always take care when giving antibiotics whenever the patient admits not to having taken such treatment previously. There are a few amongst us who are allergic to certain antibiotics. Clearly a visit to the dentist as soon as possible is essential, even if the pain has subsided.

FOREIGN BODIES.

A foreign body is any extraneous matter that enters any part of the body uninvited. Splinters are the obvious example. Wood and metal splinters are the most common. One is very prone when gathering in fire wood and thorns from bushes can be particularly irritating. The main problem with such injuries is that they are rarely clean and so there is a high risk of infection. First cleanse the area around the splinter and remove with a needle which has first been sterilised over a flame. If possible use tweezers to finally extract the exposed splinter before applying a dressing to the area.

Another foreign body which may cause a problem is a fish hook. Often only the point of the hook enters the skin in which case the hook can easily be removed pulling it out back the way it went in. If, however, the barb is caught under the skin and you have to remove it (rather than have the hospital attend to it) then first cut the line from the hook. Then push the hook on through the skin until the barb protrudes. If you can, cut the barb off with pliers, otherwise continue to pull the hook through the skin to remove it altogether. Remember that with any penetrating injury there is always a danger of Tetanus - a booster dose may be necessary.

BITING INSPECTS.

Such insects can be a real menace in the Arctic and Sub-Arctic in summer time. In Scotland I have been driven to distraction and I never head north without packing a 'mossie- net '. I once read that, " the itch to head north is nothing compared with the itch of being there"!!

We once camped by the Copper River in SE Alaska, and the bugs were really bad. I had several young people with me as I was leading a British Schools expedition. One young fellow turned up for breakfast and I really did not recognise him, - his face was so swollen. In the event he became no worse for the experience, but he was quite a frightening sight.

Apart from mosquito netting worn as a veil and used in your tent there are fairly good insect repellents available. Most contain M.M. DIETHLMETATOLUAMIDE, (DEET), often with other ingredients. My own favourite is Jungle Formula containing DIETHL TOLUMIDE. I also take a few Mosquito Coils which I light in the tent and which burn slowly giving off a midge repellent. My message is do not underestimate the power of these little creatures to drive you off your camp site either back on the water or up to the ridge to catch the breeze.

As for insects such as bees, wasps and hornets or jellyfish such as Portuguese-Men-Of -War, which cause stings which are more painful than dangerous, there is not a lot you need do to to protect yourself other than not taking a swot which only makes these creatures angry. Some people, however, are allergic to the poison. Try and carefully remove the sting and attempt to reduce the swelling by applying a cold compress. For jellyfish stings apply smooth calamine lotion.

PAIN.

Most injuries are not particularly painful, a dull ache being a more accurate description once the injured part is at rest and adequately splinted. In burns and in some other injuries pain is intense and continuous. Morphine or its substitutes have dangerous side effects in wounded persons. Recently other strong analgesics have become available that are free of such side effect.

Needless to say, nothing at all should be administered. to relieve pain if the patient is likely to be evacuated to hospital or examined by a doctor. Analgesics will mask any signs and symptoms and surgical intervention is not possible soon after the patient has ingested any alcohol.

Suggestions for a First Aid Kit

Triangular bandage x 1 (will double as bandage or sling)
Crepe bandage 75 mm x 1
Gauze bandage 50 mm x 1
Elastoplast 75 mm x 1
Steristrips 5 packs (to close small cuts)
Gauze dressings 50 mm x 50 mm x 10. 100 mm x 100 mm x 10
Sterile non-adhesive dressing (Melolin) x 5
Bandaids
Cotton wool
Paraffin gauze 5 sterile individual packs (for burns)
Scissors
Tweezers (good stainless steel)
Safety pins
Savlon ICI (or other disinfectant cleaning agent)
Cicatrin antibiotic powder
Additional items for Extended Expeditions
Thermometer
Space blanket (for rewarming casualties)
Syringe 2cc x 2 plus needles
Tinaderm powder (for athletes foot)
Inflatable splints
Laerdal resuscitation mask
Oil of cloves (for easing toothache)
Dental kit (see your dentist for advice)
Moisture cream - e.g. Nivea (to ease cracked hands and lips)
Drugs
Sea sickness tablets - personal preference
Paracetamol
Codeine
Strong pain killers, e.g. Fortral (pentazocine)
Magnesium Trisilicate tablets (for stomach upset)
Lomotil tablets (for diarrhea - NEVER in children)
Senokot tablets (for constipation)
Calamine lotion (for bites, stings, sunburn)
Sunburn lotion or cream (must contain para-amino benzoic acid)
Antibiotic - e.g erythromycin

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IMMERSION (Drowning)

Deaths from drowning are one of the leading causes of accidental death in this country. The high incidence among the young and healthy section of the population, together with the excellent prognosis for those resuscitated, from apparent death, should encourage all to have a good understanding of the underlying physiological and pathological disturbances and the management arising from this understanding.

Before going on to drowning and how to treat a victim of drowning, I want to briefly discuss the effect of initial immersion as, for example, following a simple capsize.

It is necessary in my view, to experience cold water immersion in controlled circumstances. I used to go on the sea off the Isle of Wight with small groups and at the end of the winter, when the water is at its coldest, it surprises me how quickly we become quite chilled and need to get back into the kayaks and paddle vigorously around to get the circulation going again and so feel warm. If you use a swimming pool to practice your rolling and deep-water rescue drills, then once you have mastered the basics, get on the sea in among reasonably realistic conditions and then try these drills; it is, as they say, a 'whole new ball game' in that a swimming pool expert is more than likely to fail.

Most kayakers capsize in the early stages of learning and usually in well controlled circumstances such as with competent instructors who can soon return the capsized paddler to the kayak. The problem comes with the competent and experienced paddler who finds himself or herself in suddenly deteriorating conditions and is capsized by a freak wave or sudden squall. Given that there are other kayakers present then a rescue is soon affected and the whole group is able to paddle onto shelter before taking a good look at the capsized kayaker to ensure there is no other assistance required.

If conditions are that bad they have brought about the capsize and swim of a competent paddler then they are usually also bad enough to prevent a successful rescue, indeed a solo paddler will find a re-entry into a righted kayak or a re-entry and roll almost impossible to achieve. Under these circumstances a lengthy period of immersion is likely before rescue. Normally there are two clear choices. Stay with your kayak or swim for shore. This was the dilemma faced by Geoff Hunter when he paddled his Angmagssalik round Britain in 1970.

"Pulling a little more pressure on the blade in order to support the rolling motion of the kayak there was a splintering snap and I silently sank into the murky brown water. I mentally shrieked with shock". Geoff goes on to explain why an immediate roll was not possible and how, eventually, he manages to complete a backward roll into the cockpit and then precariously manages to make his way 50 minutes later to a buoy, and then only reached it finally by swimming whilst towing his kayak. **"It was a hell of a way to swim, or so it seemed for just that 40 yards to the buoy took another three quarters of an hour whilst I struggled against the tide"**. Geoff s hold on the buoy was tenuous to say the least. **"My wet suit was doing its job', he said, but he had no protection for head and feet, hat and plimsoles being lost in the incident. The lights of Workington were clearly visible."** Here was the dilemma. Swim or stay put. Initially Geoff stayed put, but being perched on a small buoy is no fun and once it was apparent rescue was not forthcoming he made a swim for it. Eventually he made safety. **"A terrific relief came over me as I lay in the bottom of the boat knowing that I was safe. From that moment, because my first priority was not survival any more, my fatigue and cold from exposure took an instant grip and I couldn't stop shivering. Chatting to my group of rescuers I realised my speech was slurred as though half drunk. They piled me out of the boat straight into their car and took me to the local hospital. I knew what was going on around me and yet, because of the cold, my legs were like jelly and I staggered with my two assistants into the foyer where I tried to explain my journey to the Sister in my slurred drunken-like state. With very little hesitation I was soon whipped off and stuck into a boiling hot bath. I was still shivering for about three quarters of an hour afterwards, even when in bed supping an extremely hot mug of coffee laced with brandy, but after an hour I had completely recovered".**

So Geoff made it and he has kindly allowed me to publish this extract from his book as an illustration of the sort of epic that can so readily lead to serious hypothermia.

Preventing hypothermia from prolonged immersion is best done by avoiding such a circumstance in the first place by choosing the right weather and sea conditions and being with a strong group. Given that immersion is always a possibility, it is worth considering a few other precautions. Body weight, age and sex have a bearing on how prolonged immersion is coped with. For example males are more at risk than females, because females benefit from their thicker subcutaneous fat layer which gives better insulation and protection to the body core.

The medical condition of the paddler and his or her mental state are of importance. Recent illness can certainly have a contributing effect to rapid hypothermia and shock, fear and anxiety are other serious factors in. enhancing the affects of prolonged immersion. There are a few things you can do if immersion is likely to be a lengthy state. As with Geoff Hunter, having warm clothing could well make the difference between life and death. It is best to adopt the HELP position (HELP = Heat Escape Lessening Posture). If a buoyancy jacket is being worn the victim should float with his arms by his side, legs together and knees pulled up as close to the chest as possible. This will minimise the body area exposed to the cold water. If no personal buoyancy is available then any floating object will suffice.

It is best not to swim unless there is an achievable objective to so doing. Swimming increases the water flow over the body and thus heat loss. If a survival bag is available get into it and gather it round at the neck. This will go a long way to cutting down heat loss. Short term immersion problems seem common in those who have a fairly short distance to swim to safety. They are often known to be strong swimmers, but

they seem to run into difficulties after only a couple of minutes and then die rapidly. The evidence available seems to suggest that this results from a combination of factors which include pressure reducing the effective capacity of the lungs. When such cases are recovered they are usually found to have drowned and should be treated as such using usual resuscitation procedures. Long term immersion results in either drowning or hypothermia. The distinction between these two is of great practical importance. There are, of course, those who suffer from both conditions simultaneously.

Hypothermia is only likely to be a significant problem in those wearing life-jackets or buoyancy aids, particularly if there is some form of splash protection to the face. On the other hand, someone who has only been in the water for half an hour or so with no life-jacket is more likely to have drowned. There are no hard and fast rules and individual decisions about how to treat can be difficult to make when faced, with a hypothermic patient who may have swallowed water and a drowned patient who may be also hypothermic.

EFFECTS OF IMMERSION.

On immersion in cold water (15 degree C) the initial cardio-respiratory responses exhibited by most people may have disastrous consequences upon individuals with high blood pressure. The reflex increase in heart rate and the surge in arterial blood pressure may result in a heart attack which results in death or the incapacitation that leads to drowning. Young fit people may be disabled by cramp which can also cause drowning within the first few minutes of immersion. For some unexplained reason competent swimmers are unable to swim for very long in very cold water (about 5 degree C) if they are not accustomed to it. In these people general hypothermia cannot explain their incapacitation.

THE DIVING REFLEX.

The ability of diving mammals to remain submerged for prolonged periods (30 minutes plus) with breath-hold diving is dependent on a peculiar reflex shunting of the circulation. The peripheral circulation is virtually shut down and the animal becomes, to all intents and purposes, a heart/lung/brain preparation. There is a slowing of the heart rate which may be as low as 2 or 3 beats/min and which decreases cardiac output. In man there is a rudimentary diving reflex which is more marked in children and exaggerated by both cold and fear. It is possible that in the 10 per cent of all drowning in which no water is found in the lungs at postmortem - so called dry drowning - the mechanism is a manifestation of the diving reflex and death from cessation of heart beat or oxygen starvation occurs before respiration restarts.

It has been postulated recently that this rudimentary diving reflex together with generalised hypothermia explains why some individuals are capable of being resuscitated after periods of up to 40 minutes of submersion. This hypothesis gains credence when one considers that nearly all of these accounts related to small children in whom the diving reflex may be expected to be more marked and whose surface area: body mass ratio facilitates rapid cooling. In all of these cases water entered the lungs at some stage, probably in the final phase when oxygen starvation was extreme, and thus they required management for both drowning and hypothermia. Regardless of the precise nature of the mechanism that makes resuscitation feasible after such prolonged hypoxia, the obvious lesson to be learned by all is never to assume death in these cases. Attempts at resuscitation should always be made in apparently dead hypothermic victims regardless of the period of submersion and only abandoned if still unsuccessful after re-warming has occurred.

CIRCULATORY ADJUSTMENTS

Another physiological disturbance associated with immersion which in the past has received little attention in the general medical press is the effect of the hydrostatic squeeze on the body tissues and gas-containing body cavities. The pressure squeeze on the peripheral tissues of man increases venous return and produces a rise in cardiac output of 35 per cent. Nevertheless, in spite of the increased cardiac output there is a net rise in the amount of blood within the chest area. This together with the movement of the diaphragm caused by the hydrostatic squeeze on the abdomen reduces the amount of air left in the lungs by 30-60 per cent. These physiological adjustments are not likely to be of any significance in the fit young adult but may

prove incapacitating to an elderly patient with poor cardio-respiratory reserves.

Of much greater significance is the reversal of this process which occurs on removal from the water. This could well be the basis of the hitherto unexplained post-rescue collapse which is frequently described in shipwreck survivors and which for many years was believed to be associated with the 'after-drop' of core temperature. The continued fall in deep body temperature (the after-drop) seen when a cooling body is removed from a cold environment was believed to be caused by cold blood returning to the deep circulation from the cooler peripheral parts of the body. It has been postulated that many of the immediate post-immersion deaths seen in shipwreck survivors rescued from cold water are caused by disturbances to the heart resulting from this cold venous return.

It thus seems likely that the mechanism of post-rescue death is not caused by the after-drop but may be related to a sudden alteration in cardiac output following removal of the hydrostatic squeeze. Some of the success attributed to the hot bath treatment in patients suffering from immersion hypothermia may be in part owing to the restoration of the hydrostatic squeeze, although the hydrostatic pressure exerted on a body lying horizontal near the surface of the water is relatively small.

THE DROWNING PROCESS.

Whatever the cause of the incapacitation, the end result is almost invariably the same unless rescue supervenes before death from drowning occurs. Death from hypothermia in immersion victims only occurs in those whose nose and mouth were kept clear of the water by a life-jacket and even then it only happens in relatively calm conditions unless a special spray shield is fitted to protect the face. In rough seas water breaks over the face of the individual in the life-jacket so that drowning occurs when consciousness becomes impaired owing to hypothermia. Thus, submersion is not essential for drowning and unconsciousness from hypothermia is not possible unless the individual is wearing a life-jacket since death from drowning supervenes before loss of consciousness becomes total.

Accounts from near-drowning survivors suggest that the drowning process is typified by the swallowing of water initially before inhalation. Inhalation is accompanied by severe pain and violent coughing in the majority of cases.

SECONDARY DROWNING.

The utmost vigilance for secondary effects is required in all cases of near drowning. Even in those cases that appear to have made a complete recovery a water logging of the lungs may develop any time from 15 minutes to 72 hours after the drowning incident.

MANAGEMENT

Treatment of the immersion victim is aimed at the restoration of adequate ventilation and circulation, the prevention of further heat loss. All these requirements are capable of being implemented by simple first aid at the scene of the rescue. The importance of speedy and persistent resuscitation efforts to immersion victims should be emphasised during first-aid instruction. In addition, first- aid students should be warned that about 60 per cent of near- drowning victims vomit during resuscitation. The importance of expired air resuscitation over other methods of non-mechanical artificial respiration should be emphasised and the possible requirement for some intermittent positive-pressure ventilation for victims who are breathing spontaneously but arc cyanosed should be mentioned. If cardiac massage is required the advice of the American Heart Association (1974) should be taken, that is attempting to ventilate with every fifth cardiac compression without interrupting the frequency of compression. Conscious patients should be encouraged to cough and take deep breaths.

The dangers of post-immersion fall in blood pressure and continued heat loss in hypothermic patients should be emphasised. All immersion cases who have inhaled water should be admitted to hospital for assessment. When available, oxygen should be given to all en route to hospital. Ideally, all near-drowning

victims, particularly those requiring some form of resuscitation at the time of rescue, should be sent to a hospital with an Intensive Care Unit regardless of the state of consciousness. In the past drowning has frequently been regarded as the only problem requiring treatment in immersion victims. In recent years, however, there has been an increased awareness that other factors occurring on or during immersion may in themselves lead to death or be the cause of the incapacitation that eventually results in death from drowning. Victims rescued before death from drowning has occurred, may therefore require treatment from other conditions, although from the immediate life-saving point of view the correction of diminished oxygen, excessive C02 in the blood and depletion of the body's alkali reserve associated with drowning remains the first priority. Nevertheless, the possibility of other injuries should always be considered, especially in those cases not showing the expected response to treatment.

The finding in several surveys that the majority of death from drowning, even among competent swimmers, occur within 10 metres of a safe refuge strongly suggests that some physiological disturbance associated with the initial immersion is responsible for incapacitation in many cases. This being the case I believe it is worth dwelling for a few more moments on the effects of cold water immersion in physiological terms. Much work has been done on the problems of physiological variation caused by immersing part or whole of the human body in cold water. It was hoped that as a result of this work improved clothing and equipment would emerge that would help save life.

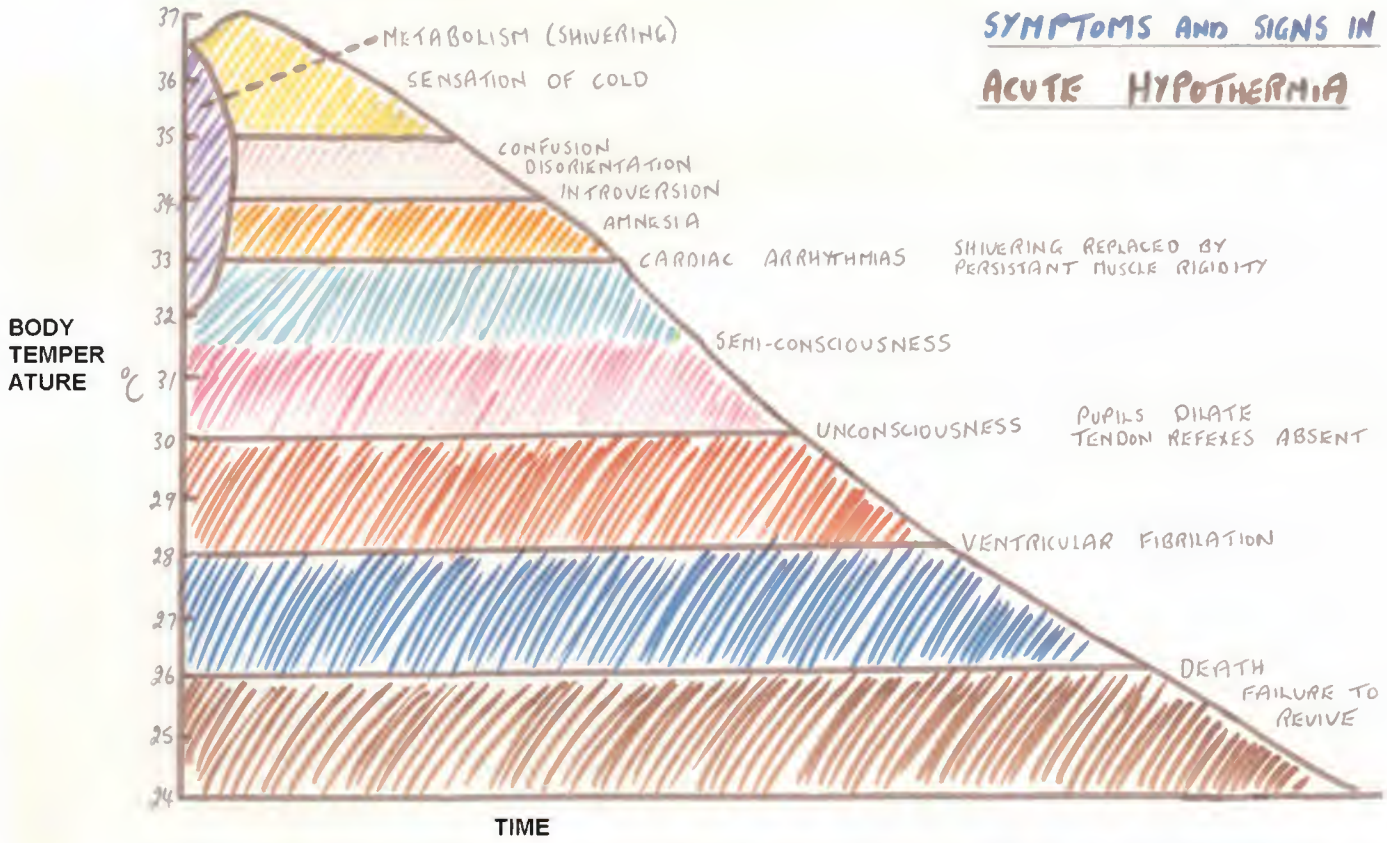
The human body endeavours to maintain an even temperature, if it becomes too warm the sweating helps to keep the blood at its normal temperature. When the body becomes too cold then blood flow to the surface is reduced. The human blood circulation can conveniently be divided into two parts for explanation purposes. One part will be called the PERIPHERAL SYSTEM which supplies blood to the muscles, limbs and skin. The other part will be called the INNER SYSTEM where the blood or core temperature is maintained around 36.8 degree C (98.4 degree F). This inner circulation supplies blood to the vital organs such as the liver, kidneys, lungs and the brain. There is a tolerable variation in the core temperature but if it falls below 30 degree C (86 degree F) then consciousness is irrecoverable and death inevitable. Even a slight variation in core temperature, however, does affect normal behaviour patterns. Essentially it is the brain which is affected first as a result of the blood being cooler than normal. It manifests itself by an interference in some of the higher mental processes such as vision, balance and speech. Blurred vision, disturbed balance and slurred speech are some of the more common signs of exposure setting in. The two systems of circulation behave differently.

If the body is exposed to cold conditions then it protects itself by reducing the peripheral blood flow in an attempt to prevent the blood from being cooled. The inner system continues to flow in the normal manner. After a while, however, which varies from person to person, a strange phenomenon takes place. This strange reaction has been called 'Cold Induced Vasodilation'. The blood vessels were initially closed or constricted as a result of the cold, now dilate or open and allow the warm blood to flow back to the extremities. This dilation process can take place locally in the hands for instance or on a larger scale maybe the whole body.

If the external cold conditions are still prevalent when the blood vessels dilate in a large area then it is obvious that eventually there is going to be a drop in the core temperature. Many lives have been lost in this way, the cold has not only cooled the blood but accompanying shock has over-stressed the nervous system which in most cases has resulted in heart failure. The mechanism involved in cold induced vasodilation is essentially a protective one for the extremities, such as the nose, ears and cheeks where the blood supply to those exposed areas in cold conditions is reduced. It is interesting to consider that the protective mechanism can result in disaster especially when the victim is immersed in cold water because here the cooling effect is even greater than in air.

It has been shown that diving in cold water increases loss of memory functions and in the ability to move. In the latter case most canoeists have experienced difficulty in moving fingers after being in cold water.

Some people can tolerate cold water for a longer time than others, and this is mainly attributed to subcutaneous fat content. A superbly fit athlete will not be able to remain in the water as long as a canoeist who supports a substantial "beer-gut'. However, some people have adapted to the cold. For example Korean diving women seem able to restrict their peripheral blood flow presumably with the onset of cold induced vasodilation, consequently losing little heat while in the water.



SURVIVAL CHANCES BY COLD-WATER-IMMERSION
by Udo Beier (DKV-Speaker of Sea Kayakers)

1998 a German sea kayaker died after a capsize in the German Bight (see Sea Kayaker, June 2001). As a captain of a German ferry did not stop to rescue him a German court had to decide if the captain was guilty for his death by hypothermia. That's why the court ordered a medical certificate by Dr. med. U.v.Laak (German marine institut for shipping medicine) to hear something about the survival times of a sea kayaker after going upside down without re-entry. In the following I discuss some important findings and complete them with other experiences.

FACTS ABOUT SURVIVAL TIMES

TABLE 1

After how many hours of immersion you have only a 50%-rate of survival?

WATER TEMPERATURE	MINIMUM	MAXIMUM
+05° Celsius / 41° F	1.0 hours	2.2 hours
+10° C / 50° F	2.0 hours	3.6 hours
+15° C / 59° F	4.8 hours	7.7 hours

TABLE 2

After how many hours of immersion it is very probable to die by hypothermia?

WATER TEMPERATURE	MINIMUM	MAXIMUM
+05° Celsius / 41° F	0.9 hours	2.3 hours
+10° C / 50° F	2.5 hours	4.0 hours
+15° C / 59° F	3.0 hours	9.0 hours

TABLE 3:

Predicted survival times for lightly clothed, none-exercising humans in cold water

WATER TEMPERATURE	FAST COOLERS	SLOW COOLERS
+05° Celsius / 41° F	1:00 till 1:50 hours	1:50 till 3:00 hours
+10° C / 50° F	1:45 till 2:50 hours	2:50 till 5:40 hours
+15° C / 59° F	2:50 till 4:40 hours	4:40 till more than 12 hours

TABLE 4:

Average survival times expectancy by different clothes

WATER TEMPERATURE	DRY SUIT	WET SUIT	OTHER CLOTHES
+05° Celsius / 41° F	3 hours	1 hours	1/2 hours
+10° C / 50° F	6 hours	2 hours	1 hours
+15° C / 59° F	more than 6 hours	4 hours	2 hours

TABLE 5:
Actual facts about survival times by a 50%-rate of survival

WATER TEMPERATURE	WITHOUT PFD	WITH PFD	INCREASE (%)
+05° Celsius / 41° F	3 hours	17 hours	467%
+10° C / 50° F	6 hours	more than 24 hours	more than 300%
+15° C / 59° F	12 hours	more than 24 hours	more than 100%

Temp. Deg C.	Deg F.	Body State	Signs
37	98.4	Normal	
36		Cold exhaustion	Shivering
35	95	Mild hypothermia	Confusion, disorientation, max. shivering
34	93.2		amnesia, pain, cramp
33	91.4	Moderate hypothermia	slurred speech, persistent muscular rigidity
32	89.6		consciousness clouded
31	87.8		pupils dilate, shivering ceases
30	86	Severe hypothermia	slow pulse and respiration
29	84.2	Cardiac arrythmia	collapse
28	82.2	Unconsciouness	eye tendon reflexes, Ventricular Failure possible
27			
26	78.8	Critical hypothermia	
25	77	Ventricular Fibrillation	
24		Muscular Rigidity disappears	
23			
22			
21			
20	68	Heart stops (asystole)	
19			
18	64.1	Lowest recorded recovery	
17		Death	

LEVELS OF HYPOTHERMIA

Many canoeists experience cold hands during the winter, and each person develops his own remedy. It may be useful to note that it has been found that face warming causes a significant rise in hand temperature. It has also been found that physical fitness affected the levels of cold tolerance. It is obvious that a person who is warm prior to going on the water will maintain his peripheral blood flow for a longer time than a person who starts off cold. It is therefore desirable to do some vigorous exercise before venturing on the water in cold conditions and it is a fallacy to think that this may use up energy reserves - in fact it makes them more readily available. There is indication that a certain amount of cold acclimatisation takes place in the extremities except for the ears. In others words, if a. person constantly exposes his hands for examples,

in cold icy water he will eventually be able to tolerate cold water conditions more comfortably. It has been shown that extra body insulation is of little consequence to the rate of cooling of the extremities.

One of the main areas of body heat loss is from the head. Some physiologists state that at 40 degree C (104 degree F) (air temperature) the heat loss from the head may amount to half the total resting heat production. The back of the head is particularly vulnerable, thus a life jacket collar helps here. Distributed over the body are nerve receptors for various functions. Some receive the sensation of heat, some touch, some are for pain, etc. In some areas of the body there is a greater concentration of nerve receptors than in others as in the lips and finger tips. Conversely in other areas receptors are scarce. The head is such an area. Few cold receptors in the head make the paddler unaware of the amount of heat which he is losing. It is not only very important to protect the head from the cold, but protecting the head by a certain amount of insulation is equivalent to protecting the rest of the body with twice that amount of insulation. In other words - if you want to keep your head warm in cold weather - wear a hat.

Having now discussed, in some detail, the physiology of the body's reactions to prolonged immersion, even short term immersion, in cold water I will now discuss HYPOTHERMIA in terms of definition, causes, prevention, diagnosis and treatment.

HYPOTHERMIA

In simple terms, hypothermia is EXPOSURE to cold conditions such that the body suffers and needs to seek warmth and, in severe cases, also medical treatment. The sea paddler may often feel cold, wet and uncomfortable. The next stage leads into hypothermia. This condition is diagnosed when the temperature of the body's' core (i.e. brain, heart, lungs, etc.) drops to 35 degree C (95 degree F). This state of affairs is often called COLD INDUCED HYPOTHERMIA. Normal body hear, incidentally is 36.8 degree C (98.4 degree F).

DEFINITION.

There are three recognised types of hypothermia:-

(1) ACUTE.

This is induced by immersion in water colder than 25 degree C (00 degree F), sometimes also called IMMERSION HYPOTHERMIA and dealt with above under the effects immersion.

(2) SUB-ACUTE.

This is caused by exposure to a cold, wet environment and is characterised by its insidious onset. It is sometimes referred to as EXHAUSTION HYPOTHERMIA.

(3) CHRONIC.

Chronic hypothermia is the severe cold afflicting the elderly, malnourished, the very young and drug addicts.

The basic definition of hypothermia says that it exists when severe cooling of the body results in a core temperature below 35 degree C (95 degree F). The body has certain mechanisms which it uses to try to keep the core temperature within close limits of normal such as shivering and perspiring. These reactions are brought about by a specific area of the brain (hypothalamus) which reacts to temperature change by widening or reducing the blood vessels in the body. If the body overheats there is a widening of the arteries with an associated increase in blood flow and a decrease in viscosity. If on the other hand, the body becomes too cool then there is a restriction of the peripheral arteries which decreases the flow of blood and an increase in blood viscosity.

The bodys' sub-conscious reactions to changes in temperature will only work within fairly tight limits and if these limits are exceeded by extremes of climates then the body is unable to cope and help is necessary. If the casualty is suddenly introduced to a cold environment, the brain senses this immediately and unless there is a change in the environment the patient will shiver and the blood vessels will constrict. This constriction serves to divert blood to the body's' core to concentrate on preserving this area. This is

normally the case in acute hypothermia.
When cooling is gradual over long periods (Sub-Acute Hypothermia) and the patient is exhausted and/or hungry or the victim is in poor health, then the brain does not react in such a pronounced manner because the temperature gradient involved is not so steep. Again the circulation is restricted but because the condition lasts for longer the body has time to make chemical changes as a secondary reaction to the initial narrowing of the blood vessels. These adjustments are not completely understood but include a decrease in the fluid content of the blood as a reaction to the decreased flow and a build up of acid in the tissues due to insufficient oxygen and nutrients in the blood to carry away these acids from some parts of the body.

CAUSES.
A kayaker may be exhilarated by a cold sunny morning without wind and sets out for a coastal trip. He is comfortably clad and paddling well. After some time a wind begins to blow and he may shiver. A cloud then obscures the sun and spray or rain soaks his clothing. He begins to chill and makes every effort to warm up. The question at this stage is does he continue or find an escape route. The rain changes to sleet or snow and he is becoming fatigued. He may become a casualty due to the cold through the air or shade temperature need not have altered over this period of several hours. Exposure or hypothermia is simply caused by becoming too cold. This happens by accident, because of ignorance, inexperience or inappropriate equipment, ~ most usually a combination of these. Hypothermia occurs because water replaces air as the insulator around the body and so increases heat loss by a factor of 26. As a result the body core gradually diminishes in temperature until it consists of just the vital organs (brain, heart, etc.) and even they are cooler than normal. Evaporative heat loss is particular important and an impermeable barrier or, better still, dry clothing can be life saving.

PREVENTION.
The prevention of exposure is really quite simple; but then many accidents occur due to ignorance of the basic principles of safety.

First be adequately clothed. Remember clothes do not warm the body but merely reduce heat losses from it. Second, do not tackle too much too soon. Tiredness assists the onset of exposure as does prolonged periods of cold and wet. Third, have facilities to prevent exposure like hot drinks, emergency rations, dry clothing and a polythene exposure bag. Fourth, have a good meal before setting out. This provides a reservoir of energy for several hours, and energy means warmth. Fifth, - know about exposure.

THE CHILL INDEX (See Table following page)
From the chill index it can be seen that it is possible to quantify the cooling effect of cold environment by measuring air temperatures and wind speed. In the water the wind effect is negligible, but heat may be lost twenty seven times faster than when the body is in still air at the same temperature. This is where the wet suit comes into its own; by trapping water between the skin and the suit. It often pays to remain still when heat conservation is the aim, as moving around changes the water in between the skin, and wet suit or clothing.

DIAGNOSIS.
The development of hypothermia is often insidious and early detection can be difficult. It is normal for members of a party to complain about coldness and fatigue when conditions get rough, so beware of the real thing. Once hypothermia sets in death soon supervenes unless something is done to reverse the process. As hypothermia sets in there will be evidence of abnormal behaviour such as listlessness, lack of interest, general slowness and weakness with stumbling and possible numbness of the extremities. Later there may be complaints of cramp, nausea, vomiting, blurred vision and/or speech. The patient may be confused and lethargic making little or no attempt to help himself. A slow pulse rate may be detected and collapse is possibly imminent. If collapse occurs then shivering ceases, muscles stiffen and breathing becomes difficult. The pupils dilate and unless treatment is extremely prompt death is certain.

As the victim cools, so they undergo a series of changes which, though not predictable, should always be watched for. First there are mood changes and shivering. Note that shivering stops as temperatures full further. You will remember the plight of the Kurds on the borders of Iraq during the reign of Saddam Hussein as it featured almost nightly on our televisions. Here among the freezing mountains babies and old people die every night. Few of the babies shown on the screen were crying - they lay passive in the arms of their mothers waiting for the inevitable. They do not shiver, they have gone beyond the shivering and crying stage. Secondly as the core temperature falls to about 33 degree C the heart rhythm becomes unstable. It is then easy to tip the heart over into ventricular fibrillation or an uncoordinated quivering

WIND CHILL CHART

ESTIMATED WIND SPEED MPH	ACTUAL THERMOMETER READING °F											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-21	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-36	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-124
25	50	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148

EQUIVALENT TEMPERATURE °F

Wind speeds > than 40mph have little additional effect

LITTLE DANGER FOR PROPERLY CLOTHED CANOEIST

INCREASING DANGER

GREAT DANGER

DANGER FROM FREEZING OF EXPOSED FLESH

To use this chart, find the estimated or actual wind speed in the left-hand column and the actual temperature in degree F. in the top row. The equivalent temp. is found where these two intersect. For example, with a wind speed of 10mph and a temperature of -10°F, the equivalent temperature is -33°F. This lies within the zone of increasing danger of frostbite, and protective measures should be taken.

contraction of the heart muscle which if not checked, will rapidly lead to death.

TREATMENT.

Treatment consists of simply getting the patient warm and dry by whatever means possible. If a hot bath is available, a.s at a Sports Centre, then immerse the patient in water at 40-44 degree C (104-110 degree F). The 'hot bath' treatment should be done under medical supervision if at all possible. The patients' body and not their limbs is immersed. All in all it is a complicated subject; briefly what can happen is this - with the skin of the body suddenly becoming heated the 'core' of the body sends blood to the skin to effect cooling. This can cause a small but fatal drop in the body's core temperature causing shock and maybe death from hypothermia. The only possible justification for rapid re-warming of cases of outdoor hypothermia is in cases not of exhaustion exposure, but of immersion hypothermia (which are different conditions) and in cases where because of accidental complications of maltreatment, the patient fails to respond to the conservative treatment and a doctor thinks the risk of rapid re-warming is a justifiable last resort.

Hardly such luxuries as a hot bath are available to the sea canoeist, and the answer is to land, find shelter and warm the patient by any means possible. All the body requires warming. Do not massage arms and legs. Strip off wet clothing, apply dry, and sandwich the patient between as many people as possible in a polythene bag and/or tent. Complications unfortunately are not unusual. Know how to administer expired

air resuscitation (mouth to mouth). Unfortunately if the heart is fibrillating there is no possibility that its normal rhythm can be resumed until the core temperature has risen above 33 degree C. It is for this reason that external cardiac massage should NOT be attempted in the hypothermic - you will most likely tip the heart over into fibrillation and will then be committed to continuing cardiac massage until the patient has completely re-warmed - perhaps for as long as 7 or 8 hours. If you are tempted to stop before then, you will have effectively killed someone whose circulation may well have been just adequate for their hypothermic state.

Current thinking on the treatment of acute hypothermia advocates extreme care in handling the casualty and re-warming. If the patient is conscious then it is usually safe to re-warm them in a hot bath as described above but with the limbs in the water. It is generally best to slowly re-warm the more serious cases as in a sleeping bag, for example. Mouth to mouth resuscitation should be offered, if you consider their breathing inadequate, but bear in mind that a cold body needs a lot of oxygen and a lot less circulation than a warm one. The fact that you cannot observe breathing or a pulse does not always mean that their respiration or circulation is inadequate.

Earlier, we spoke of SUB-ACUTE hypothermia, which I said was caused by an insidious onset of severe cold. Because of the metabolic changes involved in sub-acute hypothermia, this is a much more difficult problem to deal with, both in diagnosis and treatment. Much research is being done in this field, especially by the Navy, and the treatments recommended vary somewhat. What is given here is the latest recommendations for treatment. The casualty should be immobilised and insulated from the environment. Dry clothes should be put on with the minimum of handling. The casualty should be kept as warm as possible. If conscious the casualty should be given warm drinks in limited a.mounts. There are two schools of thought on the best way to re- warm a victim of sub-acute hypothermia. One is the traditional method of getting the casualty into a warm environment, pulling him into a sleeping bag with another warm body, preferably skin to skin contact. Some will say that this will cause an increase in blood flow from the peripheral areas to the core because this is where the heat is being applied. They recommend that the casualty should be placed in a neutral environment, that is, kept where the body can warm up through its own mechanisms.

The treatment employed will largely depend on practicalities. In a group situation where there is the possibility of further cases developing, the former method is probably better psychologically. It is to be stressed that rapid re~warming must not be used in the case of sub-acute hypthermia because this will open up the peripheral blood vessels and cause a rapid decrease in blood pressure due to the decreased fluid volume, which is normally fatal without special medical equipment and assistance.

Handling of the patient is very important as even the smallest extra demand on the heart may be too much for it. The patient should therefore be handled as little as possible and, if absolutely necessary, very gently. If the patient requires transporting then this should be done with the head slightly lower than the body. Pressure to the abdomen must be avoided as this may cause heart failure. This is a major problem in helicopter rescue cases where a harness is the only practical method of rescue. In all cases there is no substitute for proper medical attention and this should be obtained as soon as possible. Until this is available anything we do has to be seen as first aid only. A further complication in extreme cases or those involving drowning, is the possibility of a failure of the respiratory or circulatory systems. If failure does occur then treatment in the form of Expired Air Resuscitation (EAR) and External Cardiac Massage (ECM) which are both explained in greater detail earlier in this chapter.

Hypothermia is a condition which can strike anyone involved in outdoor activities at any time of the year in the U.K. and can only be avoided by being aware of the consequences and taking the precautions indicated in this chapter. Certainly prevention is better than cure. Research on this subject continues and I have referred to alternative treatment methods. Those whose responsibility it is to look after the safety of others, be this in a teaching situation or whilst on an expedition in a peer group, are obliged to keep

themselves 'au-fait' with the latest acceptable forms of treatment.

HYSTERIA

In some cases of severe cold an element of hysteria may be present. This is not to be confused with purposeful malingering. Unlike the latter, hysteria is the result of a subconscious desire to escape from an intolerable situation. Even though its presence is suspected, the full treatment must be given until the patient is safely disposed of. The only damage done will be to the pride of the rescuers when faced with the apparent miraculous recovery of their patient when safety is secured.

CONCLUSION.

I have given a fairly comprehensive account of cold water immersion and hypothermia. Hopefully you will not have to cope with these conditions during your kayaking career but the law of averages says you almost certainly will if you kayak for long enough and often enough.

Knowing what to do, what not to do, and more importantly, knowing how to avoid it in the first place will almost certainly mean you will be responsible for saving someone's life - and that life could well be your own. DO NOT UNDERESTIMATE THE EFFECTS OF COLD.