SHENANDOAH MOUNTAIN RESCUE GROUP

BASIC MEMBER TRAINING COURSE Fall 1981

Handout #1: Survival and Wilderness Travel

Contents

Primary Readings

1) Surviving the Unexpected Wilderness Emergency, Ch. 1-9

2) Wilderness Medicine, entire book

Skills Readings

1) (A5) Movin' Out

2) (A8) Freedom of the Hills and Fundamentals of Outdoor Enjoyment

BLUE RIDGE MOUNTAIN RESCUE GROUP
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INSTRUCTOR'S LESSON PLANS
Cover Sheet

COURSE: AUXILIARY TRAINING COURSE

LESSON: Part 2: SURVIVAL

PREPARED BY: KEITH CONOVER

DATE: 21 Sept 1979

All reviewers please sign (N.B. please initial all comments in text)

Date	Name	Comments
OCT. 79	K. CONOVER	TO BE REVISED & TIME ADDED AFTER 6 MO. EXPERIENCE WITH LESSON PLAN

(Continue on reverse if necessary)

☑ APPROVED OCT. 79 (Date) Keith Conover (Training Officer)

☐ REVISED AND APPROVED (original with comments in Group files)

(Date) (Training Officer)

TIME (ELAPSED) ACTUAL	CONTENTS	AV AIDS INSTRUCTOR NOTES
	I. Introduction A. Survival priorities: B. How long can you be lost in VA? C. Short-term survival is important here. D. Short term survival means shelter from environment, mostly temp. extremes.	Chalkboard Food — weeks Water — days Shelter in a storm — hours Air — minutes
	II. Heat balance concept A. Body produces heat; must regulate heat loss to maintain stable temp. B. Body core temp. must be close to 99°F for chemical reactions to work right. C. Challenge: to use equipment and knowledge to help body stay near 99°F., in harsh environments.	SLIDES 1. TEMPERATURE BALANCE 2. NARROW RANGE 3. MOUNTAIN SCENE
	III. Heat loss and compensation A. How is heat lost? B. 3 major causes of outdoor heat loss: --temperature (primarily cond. & rad.) --windchill (convection) --wetchill (conduction & evaporation) NOTE: most clothing has a conductivity near that of water when wet. C. Winter cold gives temperature chill, but worst is around 32°F with wind and rain: HYPOTHERMIA WEATHER. D. People often caught unprepared by storms in summer; wind & wetness can cause cold problems even at 60°F! E. Proper gear is important: --adequate raingear important, but even with raingear, wetness is still a problem; so,	4. HEAT LOSS WAYS 5. CONVECTION (stress) 6. WINDCHILL FACTOR 6.5 WET WINTER SCENE 7. RELATIVE CONDUCTIVITY 8. GLACIER 9. STORM 10. STORM CARTOON 11. RAINGEAR CONDENSATION

BLUE RIDGE MOUNTAIN RESCUE GROUP
INSTRUCTOR'S LESSON PLANS
COURSE: AUXILIARY
LESSON: Part 2: Survival

21Sept79KC
Date Initials

TIME (ELAPSED) ACTUAL	CONTENTS	AV AIDS INSTRUCTOR NOTES
	(III.E.)	
	--clothes must be warm when wet!	12. FABRIC COMPARISON
	--cotton is useless as insulation when wet, and wicks water.	
	F. The 3 "W"s for cold/wet protection:	
	--WOOL	13. WOOL AND WINDPROOF
	--WINDPROOF	
	--WATERPROOF	14. WATERPROOF
	G. 2 plastic leaf bags, a plastic tube-tent, or a tube storm shelter gives light, cheap wind & rain protection.	15. STORM SHELTER
	H. With proper knowledge and equipment (not necessarily fancy or expensive) you can be comfortable in hypothermia weather.	16. HAPPY WINTER HIKER
	IV. Heat loss physiology	
	A. How does body first react to threats to core temperature?	17. FIRST LINE OF DEFENSE..?
	B. By changes in the skin.	18. NORMAL SKIN
	C. Hot → flushing(expanded blood vessels near skin) & sweat.	19. HOT SKIN
	D. Sweating causes loss of salt and water; too much loss of either one, or simply excessive heat, may cause heat emergencies (will discuss later).	20. BODY WATER IS LIMITED!
	E. In a hot environment, cover up with loose clothing, ration your sweat, not your water, and recognize dehydration: Dark urine, dizziness, nausea, tunnel vision, thirst (although thirst not a good indicator of water depletion)	20.5 HOT ENVIRONMENT note it's also a winter problem.
	F. Cold → shrinking of blood vessels, cooling skin.	21. COLD SKIN

TIME (ELAPSED) ACTUAL	CONTENTS	AV AIDS INSTRUCTOR NOTES
	(IV.) G. This cooling creates an insulating shell around the core; but note the neck and head stay warm because of continued blood supply to the brain. "If your feet are cold, put on a hat."	22. PERIPHERAL COOLING 22.5 BALACLAVAS
	H. If core is still cooling, <u>shivering</u> will occur, increasing heat production, but at the cost of <u>exhaustion</u> (depletion of energy stores) and <u>fatigue</u> (buildup of waste products).	23. EXHAUSTION AND FATIGUE
	V. <u>Cold problems</u> A. Of the two major cold problems, <u>hypothermia</u> is far more serios than <u>frostbite</u>, because hypothermia → death.	24. HYPOTHERMIA AND FROSTBITE
	B. Hypothermia = decreased core temp.; when skin cooling, shivering, and adding clothing aren't enough. --physical + mental impairment --shivering --withdrawal --may not notice in self due to mental effects --often occurs above freezing, even in VA summer nights --most who get to stage of not being able to stop shivering <u>can't</u> rewarm self without external warmth.	25. TOO COOL!
	C. If person gets hypothermic in field, --recognize the problem --stop exposure --change into dry clothes --force candy or gorp, hot drinks.	26. BODY COLD PROBLEMS

TIME (ELAPSED) ACTUAL	CONTENTS	AV AIDS INSTRUCTOR NOTES
	(V.)	
	D. If a person must be rewarmed, use a sleeping bag with another warm body in it; DON'T put in bag alone.	27. HYPOTHERMIA
	E. Rapid rewarming (e.g. in tub of water) may cause shock and heart failure; do so only if you know how.	
	F. Above all, <u>prevent</u> hypothermia!	28. WINTER SCENE
	G. Frostbite is the freezing of tissues	29. FROSTBITE
	--"Frostnip" is in upper skin only, should be rewarmed in mouth, armpit, etc.	
	--Deep frostbite is white, numb, and "wooden"; can walk on frozen feet, but not on thawed ones.	
	--Frostbite should <u>never</u> be rubbed; ice crystals will damage tissue.	
	--Treatment is to rewarm rapidly in 105°F water (but no hotter--no temp. sensation in frozen limb).	30. FROSTBITE BLISTERS
	--Frostbite is always caused by unusual, preventable causes:	
	-fatigue, exhaustion, illness, or hypothermia	
	-sudden intense cold (e.g. supercooled gasoline or alcohol, or cold metal against the skin)	
	-Restriction of circulation (e.g. tight boots.	
	--Trench, or immersion, foot is like frostbite, but caused by cold and wet above freezing, and by tight boots.	31. FROSTBITE LATE
	--Frostbite turns red and blisters,	

TIME (ELAPSED) ACTUAL	CONTENTS	AV AIDS INSTRUCTOR NOTES
	(V.G.) then turns black and automatically amputates injured parts. H. Important point: hypothermia and frostbite are easily prevented, but difficult to treat.	31.5 WINTER SCENE
	VI. Heat Problems A. Lack of salt, lack of water, and heat caused (usually) by summer weather may cause 3 major problems:	32. HEAT AND DEHYDRATION
	B. Heat Cramps --caused by lack of salt replenishment --usually in legs or abdomen, not relieved by massage --replace the salt (best at meals) --if salt tablets used, take plenty of water.	33. HEAT CRAMPS
	C. Heat Exhaustion --dehydration → collapse --looks like shock: cold clammy skin, rapid pulse, temp. normal. --normal response to overexertion in hot environment. --rest in shade, drink salty fluids, put feet up.	34. HEAT EXHAUSTION
	D. Heatstroke --A true medical emergency: 50% mortality. --failure of part of brain regulating temperature → sweating stops. --skin hot, dry, red; person appears very sick. --Must lower, and control, temperature. --Transport with standard first aid.	35. HEATSTROKE

TIME (ELAPSED) ACTUAL	CONTENTS	AV AIDS INSTRUCTOR NOTES
	(VI.) E. Review: Heat Exhaustion--normal response; cold, clammy, pale; rest with feet up in shade, and drink salty fluids. Heatstroke--true emergency; hot, dry, red, sick; cool off and transport.	36. COMPARISON
	VII. Survival A. Avoid panic: use the Stop Think Observe Plan mnemonic B. Know your abilities; don't overextend yourself. C. Don't let artificial goals (like finishing a summit climb) cloud your judgement. D. Be prepared for sudden changes in weather, and other problems, by keeping spare food, water, clothing, and shelter in your pack. Your pack is your life-support system in a hostile environment, so E. DON"T GET SEPARATED FROM YOUR PACK!	37. WILD SCENE 38. PEAK 39. BACKPACKERS 40. CARTOON 41. SUNSET

CHAPTER SEVEN

SURVIVAL AND WILDERNESS TRAVEL

7.0 GENERAL

The texts Surviving the Unexpected Wilderness Emergency and Fundamentals of Outdoor Enjoyment provide ample coverage of all of the standards for Level II GSAR certification, with the exception of some winter considerations, discussed in 7.1, conditioning for GSAR activities, discussed in 7.2, and hypothermia, discussed in Chapter 10. The related subject of personal equipment is dealt with in detail in Chapter 12. Those aspiring to the Level III GSAR standards should consult Mountaineering: The Freedom of the Hills and Winter Hiking and Camping for additional information concerning wilderness travel.

7.1 WINTER CONSIDERATIONS

The text Winter Hiking and Camping deals extensively with the process of coping with winter conditions. Level III GSAR team members should be familiar with much of this material. Level II GSAR team members should be familiar with some basic winter considerations not discussed fully in the Level II references. These are set forth below.

Wool. Only wool will retain warmth when wet, and wetness of all clothing is a situation that must be expected by winter travelers. Lots of wool clothing is necessary.

Dry. Wetness, even with wool clothing, is to be avoided. Ventilate well, avoid overheating, and brush snow off clothes before it melts.

Avoid frostbite. Frostbite may occur from direct skin contact with metal, so wear thin liner gloves to keep skin from freezing and sticking. Also, volatile liquids such as gasoline may cause instant frostbite if spilled on the skin.

Avoid trenchfoot (immersion foot). Prolongued exposure to cold, especially in wet-cold conditions, may cause tissue to die due to lack of blood. This may occur at temperatures above freezing, but will look like frostbite. The prevention is the same as for frostbite.

7.2 CONDITIONING

Ground SAR tasks may be demanding and physically strenuous, so GSAR team members must be physically, emotionally, and mentally prepared for such stresses. Physical conditioning is part of this preparation.

The most obvious reason for physical fitness is the ability to hike out on an assigned task, and to be able to carry it out without being excessively fatigued. One of the less obvious reasons is for individual and team safety. A fatigued person's senses, agility, and resistance to illness and injury (e.g. hypothermia) are extremely diminished. Another reason for conditioning is the confidence it creates.

There are 3 aspects to fitness for GSAR: strength, flexibility, and endurance. Strength is of obvious importance, but is useless without the flexibility required to use strength effectively. Endurance requires the provision of oxygenated blood to the working muscles. In order to accomplish this effectively, the cardiovascular and respiratory systems must be built up by endurance training. Long, hard exercise without rest breaks is necessary to build endurance.

Conditioning for GSAR tasks will make SAR tasks easier and will produce additional benefits in terms of personal health and fitness.

7.3 REFERENCES

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Roberts, Harry: Movin' Out, Stone Wall Press, Lexington, MA 1975.

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Van Lear, Denise: The Best About Backpacking, Sierra Club Totebook, San Francisco, CA 1974.

Some quick additional notes:

1. Alcohol causes vasodilation in the skin, an increased blood flow, and therefore warmer skin. This creates a feeling of warmth, but causes an increase in heat loss.
2. Tobacco causes the exact opposite: it causes vasoconstriction, a decrease in skin bloodflow, thus setting the stage for frostbite.
3. Energy values of food:

	Calories per pound
Protein	1800
Fat	4100
Carbohydrate	1800

Fat is the most weight efficient, but carbohydrate is easier to digest.

4. Carbohydrate provides the quickest energy, but it doesn't "stick to your ribs" or last a long time like a meal high in fat and protein does. Some protein and fat is required every day, and the daily requirement for fat seems to go up in cold weather. There is also some evidence that high-fat diets provide protection from cold effects.

CHAPTER TWELVE

PERSONAL EQUIPMENT

12.0 GENERAL

The selection and care of equipment to be used in the field should be based upon certain basic principles. These principles remain constant despite technological advances in gear.

Versatility is a primary concern. Items that serve multiple purposes save weight, and generally simplify matters. Instead of carrying a cheap compass, a ruler, and a signal morror, the GSAR team member might, for example, consider a Silva compass with a mirror (e.g. the Ranger or Safari models). This not only increases navigational accuracy but the single item also serves as a straightedge and signalling device. This is but one example. Careful consideration can save bulk and money.

Proper care of equipment cannot be overemphasized. Under certain conditions the condition of your equipment may determine whether you live or die. SAR is a strenuous activity, and equipment failures must be anticipated before going on a REDCAP.

Care in the field includes considerations such as keeping things as dry as possible, keeping your gear organized, not submitting equipment to stresses it is not designed for.

Careful consideration before buying will save money and anguish. Literature on equipment is bountiful; for example Harry Roberts: Movin' Out and Movin' On contain good discussions of personal gear. Freedom of the Hills by the Mountaineers (ed. Ferber) contains good sections on equipment also, particularly technical gear and its use. "Backpacker" magazine contains discussions and evaluations of different products. An excellent source of information is the personal experience of others. Ask backpackers about their gear. Visit your local outdoors store--the salespeople will probably be eager to talk with you about items of equipment.

Carrying a patient in a litter is enough burden for most of us. A fifty pound pack is an unnecessary addition to this load. Keeping weight to a minimum without compromising efficiency requires thought and planning, but it's worth the effort.

12.1 BOOTS AND SOCKS

Boots. SAR places great stresses on equipment. This is particularly true of boots. Buying a cheap pair of boots is false economy. Good fit, good leather, and good workmanship cost money but a quality pair of boots, with good care, will far outlast a cheap pair.

Comfort, support, and protection are the major points to consider. A comfortable, proper fit will eliminate great discomfort. Boots should be roomy enough for the toes not to get jammed against the front while decending, but should allow the ankle adequate support. A medium-weight hiking boot, with a 3/4 length shank for rigidity, is a good choice.

Protection from the elements is one primary function of boots. A good welt construction (e.g. Goodyear, Norweigian) will keep feet drier. A boot constructed of a single piece of leather, with a seam along the Achilles tendon, is preferable to one with seams on the sides. A gusset or bellows along the tongue will also aid in holding back water. To help the boot keep feet dry, waterproofing is applied. Oil-based materials such as mink oil should not be used on chrome-tanned leather (most hiking boots are of this leather). Instead, Sno-Seal or TLC, liberally applied, should be used as needed. This is particularly true around the welt, the area most subject to leaking. The waterproofing should be kept off the glued sole

joints below the welt.

It is crucial that the boots be "broken in" before attempting an ambitious task involving a lot of walking. This is best done at home or on short hikes.

Socks. Single boots (as opposed to double ones for winter mountaineering) afford little protection from cold. Feet are kept warm by proper use of socks. Wool socks are about the only ones worth wearing. Typically two pairs are worn, a thin smooth pair (a liner sock) under a larger, heavier pair. This reduces the chances of blistering. Boots should be fitted to feet with two pairs of socks. Do not wear more socks than your boots are fitted to--instead of keeping your feet warmer, the tightness will cut off the blood supply to your feet, and they will be colder than ever.

Care. Wet socks are cold. Keep two extra sets, and rotate frequently (perspiration will get your socks as wet as stepping into a pool of water). Wrapping the extra pairs in plastic is a good idea.

Boots have two enemies: heat and water. Never dry boots at anything over room temperature. Better yet, try to avoid getting them wet. By its very nature, SAR involves adverse conditions, but with proper planning and awareness, discomfort is easily minimized.

12.2 PACKS

A large pack has a tendency to become full of unneeded gear. A good pack for SAR is a rucksack large enough for certain personal equipment and some team gear (e.g. medical kit, radio). It should have provisions to lash other gear on the outside. Pack failures are usually disastrous. A rugged, well-sewn pack is less likely to succumb to abrasion and abuse.

Whether the pack is a single or divided compartment, opens from the top or the front, has a waistband or not, are matters of personal preference. Ask around.

Some provision should be made to keep water off gear in the pack. Wrap important items, e.g. sleeping bag, extra clothing and socks, in a plastic trash bag, and put a waterproof cover over the pack. A trash bag will serve for this, too.

The load should be high and close to the back. A proper fit is essential for comfort and reduction of fatigue.

12.3 SLEEPING BAGS

Cloth sleeping bags are useless in SAR. They are hopelessly bulky, heavy, and will keep you warm only in the summer. You have a choice of down or a synthetic fiber like fiberfill. Down is lighter, and carries more compactly, but is worse than useless when wet. Synthetics are heavier, and don't roll up as small, but the water can be shaken out of them, and they will still be serviceable. There are also dozens of cuts, constructions, weights, and prices. A mummy cut means less weight and bulk than a comparably warm bag in a rectangle style. A bag with sewn-through stitching will be much more cold than a bag that is not sewn through--that makes a real difference. An expedition bag is not as suitable for GSAR as a three-season bag would be (for Virginia), because for nine months out of the year, the bag will be too warm and too heavy. You don't have to freeze the other three months, though, if you carry a light, inexpensive liner bag or bivouac sack. For further comparisons of the types of bags available, the reader is urged to consult the available literature, and talk with backpackers.

If you are carrying a sleeping bag, it is well worth the trouble to carry along an ensolite pad, at least the length of your shoulders to your hips. It doesn't matter how warm your bag is, you will be cold without anything insulating you from the cold ground, because that's where all your heat will go--straight into the ground.

12.4 LIGHT SOURCES

Often the team member will be expected to function in the dark. A strong, dependable light is vital. Two basic types of lights exist: handheld and headlamps.

Headlamps are preferable for SAR as they free the hands from holding a flashlight. Miner's lamps cast a strong light, but are often hard to obtain, and are heavy. They are, however, nearly indestructible. "Justrite" and "Wonder" headlamps are very popular. The Justrite will accommodate standard D cells, but the Wonderlight requires a special battery. The Justrite can also focus the beam cast.

Cavers are fond of carbide headlamps, but these burn with an open flame and are not very weatherproof and cast a relatively weak beam. They are therefore not at all suited for above-ground SAR.

A large variety of hand-held flashlights are on the market. For personal use a small one, such as Mallory, will suffice.

Problems. Light sources require a good deal of care. Run-down batteries, dirty contacts or a dead bulb all will result in continued darkness. Chances are if there's an intermittant strong beam, the contacts are dirty or corroded or bent. A constant, weakening beam indicates weak batteries. The filament of a bad bulb is usually obviously damaged. Check this if there's no light at all.

Care. Keep the light dry! Inserting a piece of plastic between the batteries and the contacts will stop them from inadvertently running down while inside a pack. Reversing $\frac{1}{2}$ the batteries serves the same function. Just remember to remove the plastic/replace the batteries in the proper position before use.

Batteries will be discussed in Chapter 13.

12.5 HARDHATS AND HELMETS

The hardhats best suited to GSAR are mountaineering helmets, specifically those manufacturered by Joe Brown, MSR, and Ultimate. These provide a maximum amount of protection from the type of impact most likely to occur.

The hardhats with adjustable headbands are able to accomodate a wool hat--a necessity under certain conditions.

12.6 CLOTHES

Pants should be loose fitting enough to allow a large degree of freedom of movement, even with long underwear. Knickers provide a great deal of mobility in addition to adjustable ventilation, unlike long pants. Combined with wool knicker socks, knickers allow one to stay dry easier than other clothing systems. Normally clothing becomes damp below the knee first, and a change of socks is all that is required to get dry again. Under these circumstances instead of carrying a change of pants, two changes of socks are carried, providing comfort as well as function.

Reinforced seats and deep pockets are advisable in any trousers, knickers or otherwise. Stay away from cotton! When worn with suspenders instead of a belt, ventilation is enhanced.

Upper body clothing. The main principle to be adhered to when selecting clothing for the trunk is "layering". (see Gene Fear) Wool fishnet underwear is superior to most other undergarmets. A dry light wool shirt worn over the fishnet and under a windshell will provide enough warmth even in cold windy weather, provided the individual is moving. This can be supplemented with a large wool shirt or tightly knit wool sweater for periods of immobility or lower temperatures. It is crucial that adequate ventilation be maintained so that clothing will remain dry! While moving the team member will be generating a great deal of heat, however upon stopping, heat loss exceeds heat gain unless additional insulation is put on immediately. Damp clammy clothing is cold!

A down parka serves admirably when kept dry; however, it is virtually useless when wet and should not be relied upon to provide needed insulation. Synthetic

fills are cheaper and do not absorb moisture to the extent that down does. They are more compressible and lighter than their wool equivalent. An item for possible consideration is a polar-guard vest. A vest provides insulation for the trunk while allowing adequate underarm ventilation.

Shell garments. There are two types: windproof and waterproof.

Windshells give protection from convective heat loss, "windchill factor". The wind parka should (1) have a hood which will accomodate a hat and/or helmet, (2) be long enough to cover the lower back, and (3) have a drawstring at either the waist or the skirt or both. The windshell should be equipped with the means to adequately ventilate underneath. All zippers should have pull tabs so they can be operated with mittens. The windpants serve the same function, protecting the wearer from windchill. Wind pants must be loose enough to provide mobility without incessantly snagging on rocks, branches, the Stokes, etc. The pants should be worn inside gaiters to reduce the likelihood of snagging them with crampons or any of the above. The user must be able to don and remove the pants without removing his boots first.

Rain gear. The dilemma associated with raingear lies in the fact that it is impermeable to water. This applies to perspiration trying to get out as well as rain trying to get in. Raingear does not ventilate well and should only be worn when required by conditions. Ponchos provide more ventilation than other forms of raingear; however, they are ineffective in the presence of a strong breeze, in addition to being cumbersome (especially in brush).

Rain parkas with full zippers ventilate better than most raingear but compromise their waterproofness in doing so.

Cagoules are by far the most weatherproof of all rain gear. They can serve as an emergency bivouac shelter. When shortened to parka length and used with rain chaps (see below), they provide enough ventilation to prevent overheating while keeping the rain out. At full length with gaiters or rainchaps mobility is impaired; however, this system is more weatherproof than any other. In SAR situations where one does not have the opportunity to "come in out of the rain", the cagoule is the item of choice for raingear.

Full rainpants, while very watertight, have almost no ventilation unless equipped with zippers on the legs. Unfortunately, opening a zipper to the elements results in a well-ventilated wet rescuer. An item worthy of consideration is a pair of rainchaps. In addition to being light and compact, when used with at least a 3/4 length parka, rainchaps are efficient waterproofing, with ventilation.

Gaiters. Gaiters serve many purposes--they can fill the gap between a full cagoule and boots. They prevent snow and/or mud from entering from the boot top. Two lengths are in common use, long (up to just below the knee) and short (just over the boot top). Furthermore, they can be obtained either in waterproof material, or uncoated. Both materials are windproof--a major function of gaiters is to break the wind. Choice is an individual matter. A possible suggestion is a pair that is waterproof up to the ankle, but breathable between the ankle and the knee. The type with the zipper in front are easier to get on than the ones with the zipper in the back.

Headgear is of vital importance. No team member should venture into the field without a wool balaklava. Winter conditions often require this to be supplemented with a parka hood. The amount of heat lost from the head and neck is well documented.

Another area of heat loss is the hands. Mittens are warmer than gloves, for the fingers are nearer together. Cold weather often dictates the use of mittens with windproof shells. Extra hat and mittens are a good idea in the wintertime.

General. "Wool is a climber's best friend." Keep this in mind when choosing clothing. Clothes should be kept clean--they're warmer and more comfortable that way. The exception is washing insulated parkas and vests. Research this before trying it. Any rips or tears should be patched promptly. Apparel should be roomy and comfortable, with emphasis on function. Try to layer your clothes so you can adjust to the temperature more easily.

12.7 PACK GEAR (MISC.)

Water bottle. U.S. Army canteens do fine here, provided they're leakproof. Often, more than one must be carried, however. When budgeting your water, don't forget the victim!

Knife. A modest outdoorsman carries a modest blade. A hatchet is no good for cutting cheese. Rarely is more than a good sharp pocket knife needed.

Compass. Most orienteering compasses are refinements on a magnetized needle housed on a functional base. The next step is to fill the housing with oil to cut down on vibrations of the needle. Luminous points aid at night. A mirror increases accuracy greatly. Magnifiers, changable scales, and adjustable declination features are of questionable value for SAR, as bulk is increased with little real benefit. An orienteering type compass with a clear base is best--see Chapter 8.

Whistle. Use a plastic one, or wrap the mouth section of a metal one with medical tape. Cold whistles are uncomfortable, and in very cold weather even dangerous. It should be LOUD!

Metal cup. It should be able to take direct heat. Keep it clean.

Storm shelter. A cagoule does a good job at this. Feet can be tucked in the pack for a comfortable (well...) bivouac. Otherwise, a tube tent is a good idea. Even trash bags work, but they tear easily.

First aid kit. Keep it simple--a little bit goes a long way. Any special medication should be carried here.

Rations. Extra food won't stay in your pack if it's your favorite candy bar. Use food you can eat, but won't be tempted to nibble on for your reserve energy supply.

Waterproof case and matches. Always leave enough to start a fire. A metal match is also useful, but practice first.

Ensolite. A small piece of ensolite, to sit on and put a stove on, is often worth having.

Other considerations for things to carry: chapstick, sun screen, parachute cord, pencil and paper, toilet paper, insect repellant, candle (or firestarter), two dimes.

12.8 TECHNICAL GEAR

It is vital that technical gear be properly maintained. This includes proper care in the field, checking over it after each use and replacing it when doubts exist as to its integrity.

Locking carabiner. One with a wide gate will fit a Stoke's basket better than a narrow gated one. 4400 pounds strong minimum. If dropped a long way, or subjected to severe off-axis loading, it should be retired. A sticky gate can be relieved by using a small amount of oil at the hinge.

Seat harness. This is subject to weld abrasion from having a rope run over it. Check it frequently. If in doubt, retire it. Webbing is cheap--errors are costly.

Tie-in. Be sure the knot is secure. Watch for burrs on the Stoke's basket that may fray the sheath.

Retired technical gear should be disposed of or otherwise segregated from gear in use (e.g. black tape).

Leather gloves. A must for all ropework. Construction gloves work fine. Get a rugged pair.

12.9 SOURCES OF SUPPLY

In the past decade, lightweight, quality outdoor equipment has become readily available in the United States. Large department stores often provide cheap wool clothes and underwear. Specialty stores are good sources of information as well as equipment. CAP channels often provide good surplus clothing. A large volume of mail order business is conducted by:

Recreational Equipment, Inc.
P. O. Box C88127
Seattle, WA 98188

and

Eastern Mountain Sports
12402 Vose Farm Road
Peterborough, NH 03458

Often your local outdoor equipment store will carry the equipment best suited to your area.

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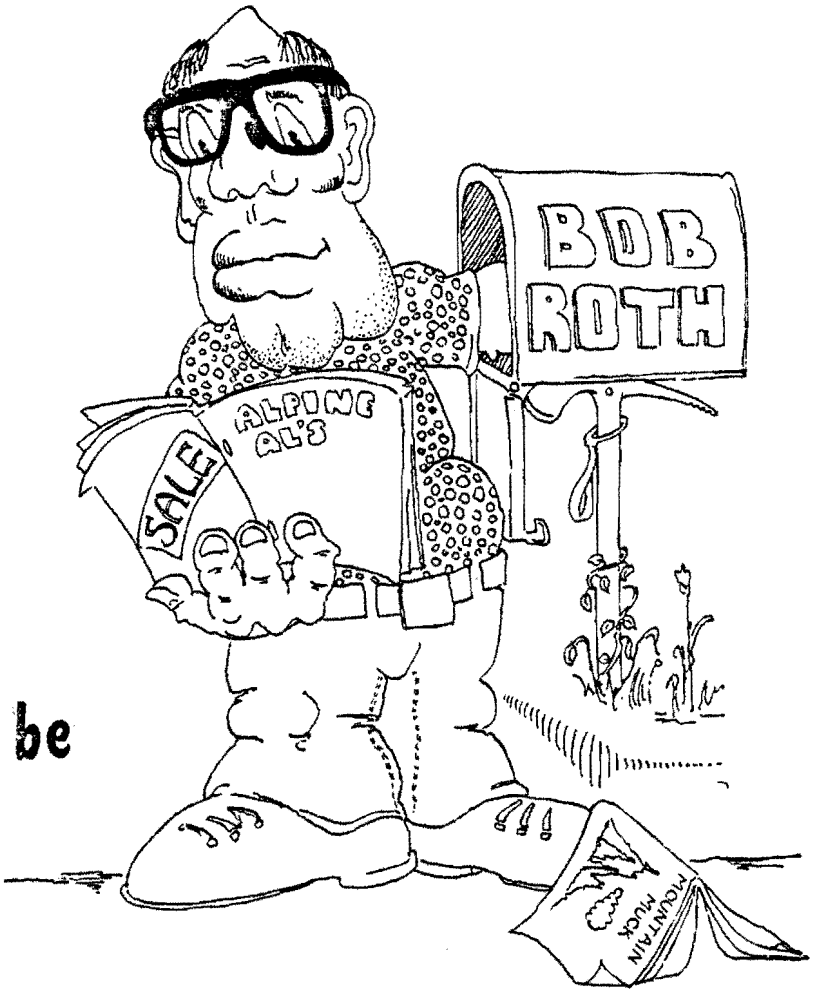
END OF 6

The COLDER you are

The WARMER you'll be



A GUIDE TO STAYING WARM ON WINTER EXPEDITIONS

Bob Roth was a practical man. He knew good advice when he saw it. So when he received a collection of winter mountaineering textbooks and catalogs full of tips on keeping warm, he knew he had it made.

For Bob Roth was a winter mountaineer, and he never seemed to have enough tips on how to stay warm. In fact, he stayed miserably cold for the duration of every winter trip he had ever gone on. Understandably, then, he jumped at the possibilities these hot tips seemed to offer.

First, he bought all the equipment the textbooks recommended. He bought dacron underwear, dacron ensolite, dacron shirts, and dacron ice-axes. Then, he threw away the dacron rope, ice-axes, and ensolite because even though they were warm when they were wet, they were useless when they were dry. Next, he bought wool underwear, wool socks, wool pants, wool scarves, wool shirts, wool long-johns, wool hats and wool sweaters, and threw away his dacron underwear, pants and shirts, since one book said that only wool clothing should be used, and wool is wet when it's not dry, and warm when it's not wet.

Then, he bought a fifteen-gallon Stetson hat to annoy Ken Goddard, who only had a ten-gallon Stetson. With an eye towards utility, Bob had chosen the hat because someone had advised him that he could always carry water in it. Someone else had said that a woolen hat was just as good when it was wet, but Roth was a practical man. He knew that the argument just wouldn't hold water.

The day of the next expedition rolled around, and Bob Roth was ready. He donned his wool apparel and shouldered his dacron pack. Before beginning, he swallowed a chunk of rock salt and slugged a hearty slug of cold water, since *Yukon Pete's Medical Manual* said, "Salt stimulates blood circulation and retains body fluids, thus reducing the possibility of dehydration, frostbite or hypothermia." He immediately felt nauseous, but Bob was a practical man. He might feel nauseous now, but he had reduced the possibility of his getting frostbite later. Looking down, he noticed he had spilled some water on his fingers as he was drinking, and they had suddenly become frozen and numb.

When they had thawed Bob's hands, the climbing party began marching up the mountain. It was a clear, cold day, with a bright sun, so Bob slipped on his new snow goggles with the narrow slits, and stepped into a crevasse when he couldn't see where he was going. After he was rescued, he swallowed some more rock salt and a few ice cubes, since his water had frozen. He felt sicker than before.

As they trudged along, Bob suddenly began to itch all over, and realized that his wool clothing was asserting itself. But, practical as he was, he knew this was a small price to pay for being warm if he ever got wet. He thoughtfully munched

Continued

some more ice cubes and rock salt as he walked along, feeling sicker than ever, and longing to get wet.

The party put on crampons and readied ice-axes as they reached the base of a precipitous ice-wall. But Bob's left foot was getting cold. Remembering that one textbook said, "If your feet are cold, wear a hat," he stuffed his Stetson into a boot, strapped on his crampons, and began to climb. As he got about half-way up, he realized his fingers were becoming cold. He recalled some wise words of advice from Yukon Pete, who said, "If your fingers get cold, a simple way to warm them is to whirl the arms like propellers around your head. This pushes blood to the fingers and gets them warm immediately." Forgetting for a moment that he was fastened only by crampon-tips to a vertical wall of ice, he dutifully whirled his arms and plummetted gracefully earthwards, knocking three other climbers off the ice as he fell. He successfully made it to the summit of the wall on his second attempt, and stumbled along after the group, nursing his bruises, scratching madly at his red, itching skin, and sucking on some more rock salt.

Ken Goddard rigged a traverse across a roaring glacier-fed stream. As Bob swung across, Ken let a rope go slack, since he was still annoyed by Roth's Stetson that was five gallons bigger than his. Bob struck the water with a resounding "Splat!", but was quickly towed to safety. The leader announced that they would bivouac there for the night, so Bob quickly set up his dacron tent and crawled inside. Using an ice-axe to undress, he realized that wool was cold when it was dry and frozen when it was wet. He rubbed his sore, red itching body down with various organic salves, and noted that the dacron in his sleeping bag dissolved upon contact with the liquids. But Roth was a practical man, and he knew that worrying about dissolution would not help solve the problem. He crawled into his depleted sleeping bag.

Bob recalled another tip from the Medical Manual advising that "eating cheese before retiring into the sleeping bag will help one stay warm on cold winter nights." He reached inside his pack and pulled out a chunk of cheese and a handful of crackers, since he never ate cheese without crackers. He stuffed some chocolate bars into his sleeping bag too, since another textbook suggested he take some candy to bed with him, and eat a bite or two whenever awake. He ate the cheese and crackers, saving the chocolate

for later. He suddenly began to itch again, and realized that it was from cracker crumbs in his sleeping bag.

Bob felt cold and began to shiver. The cracker crumbs dug into his tender skin, and made him feel even worse. He chewed frantically on some rock salt to keep from getting frostbite, and cursed *Yukon Pete's Medical Manual.* His teeth chattered violently; Roth lost four fillings that night. But he was a practical man. A catalog had said that "Shivering in your sleeping bag is an excellent way to warm your bag," so he didn't feel so bad lying there shivering from the cold. He knew he was warming up his bag.

A short while later he felt the need to urinate. Recalling that one textbook said, "Be sure to urinate (even though it may seem inconvenient) when the feeling first arises," Roth shrugged philosophically, thinking about the cold outside. But then he recalled the extra admonition, "Don't wait." He unzipped his sleeping bag and sprayed the inside of his tent. Yes, Bob Roth was a practical man.

So he lay there, shivering, teeth chattering, cracker crumbs scratching, until he remembered some more of Yukon Pete's advice: "Tensing and relaxing muscles will also help to warm one's body by generating body heat." He quickly arched his back and flexed his neck and thigh muscles. There was a resounding crack as all the seams of his mummy bag split and filled the inside of his tent with a swirling cloud of dacron fluff. Roth noted with a start that there was something warm and sticky trickling down his body, but was relieved to find that it was only his chocolate bars that had melted. He was also aware that he was shivering more violently than ever, but he was glad of that, since he would be warming up his sleeping bag more rapidly. Bob began sneezing and coughing as the dacron began to irritate his nose and throat, but the itching became less as the cracker crumbs became coated with chocolate and lost their potency. Bob stuffed as much loose dacron as he could back into his sleeping bag, munched some more salt, urinated again, and shivering quietly to himself, went to sleep.

Well, Bob Roth was a practical man. He left the expedition the next day. When he got home he sold all of his equipment except for his evil-smelling tent, which he donated to the Brooklyn Hiking Club, and his chocolate-covered, dacron-filled (with sprinkles) sleeping bag, which he donated to the manufacturer's research laboratory. They are still feverishly working to determine the origin of the sprinkles.

Bob Roth now lives happily by himself in Death Valley, going once a month to Yukon Pete's Dialysis Center for treatment of a blood salt imbalance.

Yukon Pete, you see, was a very practical man.

–Ellis Lader
Bronx, New York

* * *

Any similarity to catalogs, products, and outdoor manuals past or present is purely intentional, but you can't prove it!

(E.G. PAUL PETZOLDT)

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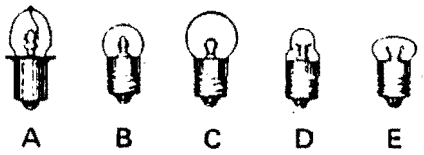

FIGURE 1-4

STANDARD G.E. BULBS

BULB GE NO.	BULB TYPE	CANDLE POWER	AMPERE DRAIN	NUMBER OF CELLS
PR13	A	2.20	.50	4
27	C	1.40	.30	
PR17	A	1.20	.30	
502	C	.60	.15	
365	B	1.60	.50	3
PR3	A	1.50	.50	
403	B	1.00	.30	
13	B	.98	.30	
PR7	A	.90	.30	
246	D	---	.22	
245	B	.90	.50	2
PR2	A	.80	.50	
14	B	.50	.30	
PR5	A	.45	.35	
PR6	A	.45	.30	
233	B	.42	.27	
PR4	A	.40	.27	
243	D	---	.27	
223	E	.38	.25	
222	D	---	.25	
PR9	A	.25	.15	
123	B	.10	.30	1
112	D	---	.22	
131	B	.03	.10	
359	B	.02	.06	

TYPE	VOLTAGE	COST/ CELL	LIFE	WEIGHT/ D CELL	COMMENTS
Carbon/Zinc	1.5V	X	Y	3 oz.	Common "battery". Low shelf life, especially at warm temperatures.
Zinc Chloride (Heavy Duty/ Industrial)	1.5V	1.5X	1.5Y	3.5 oz.	
Alkaline	1.5V	2.5X	2Y+	4.3 oz.	Works much better than the above cells in cold environments.
Nickel/Cadmium ("NICADs")	1.25V	6X+	2Y+*	3.2 oz.	*May be recharged many times; Works better than alkalines in cold environments.
Lithium	2.8V	8X+	5Y	2.9 oz.	Note that (1) one lithium cell replaces two alkaline or similar cells, due to the difference in voltage; and (2) two lithium cells replace 8 alkalines in terms of total energy. This is 5.8 oz. instead of 34.4 oz.=2.1 lbs. of battery.

FIGURE 1-2:
COMMON DRY CELL CHARACTERISTICS

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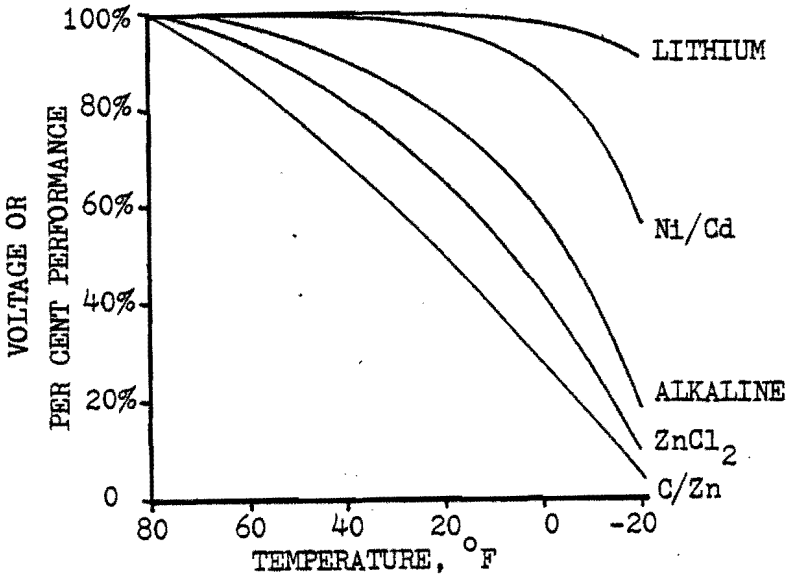

FIGURE 1-3:
DRY CELL PERFORMANCE VS. TEMPERATURE

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MOUNTAIN WEATHER

WEATHER is of prime concern to the mountaineer, since his comfort and possibly his safety are dependent upon it. Weather can not only change with astonishing rapidity in the mountains, but its patterns and effects may be surprisingly local: hypothermia has claimed victims caught unprepared for wind and rain on exposed alpine slopes, while just a few miles away others have sweltered in lowland summer heat. After an early attempt on the Matterhorn, Edward Whymper reported being driven back by a fierce storm within a cloud high on the mountain; skeptical villagers in the valley below recalled only warm sunshine under clear skies.

At 5000 feet and higher, snow can fall any time of year; excessive snowfall brings avalanche hazards to exposed slopes and can force retreat from a major peak, even in summer. Rain, snow, and verglas can present unwelcome problems to the rock climber. Fog can completely frustrate routefinding. Lightning is a particular hazard on exposed peaks and ridges. Climbs of major peaks such as Mt. McKinley frequently require several weeks due to periods of bad weather. Minor emergencies, such as simple evacuation of an injured climber, can become major problems in the face of a mountain storm. Even fair and warm weather can introduce peculiar problems such as melting snow bridges and rising streams which in the afternoon obliterate routes climbed successfully in the morning.

While the mountaineer can do nothing about the weather directly, he can learn to recognize signs of impending changes, so that he will not be caught unprepared. Even lacking weather instruments or current Weather Service reports, he can learn much about approaching weather merely by

observing clouds. If he is carrying an altimeter, his prognosis can be confirmed through observation of barometric changes: the decreasing pressure, or falling barometer, often announcing an approaching storm, register on an altimeter as a gain in altitude unjustified by physical progress up the mountain. Barometric changes are easily observed when the party remains at the same elevation, as in an overnight camp or bivouac.

WEATHER FORECASTS

The time to become concerned about the weather is not at the first rumble of thunder, but before leaving home. Local Weather Service observations and forecasts are timely and informative. Weather maps published in newspapers help in anticipating possible developments, but the information in these maps is a forecast of anticipated weather based on older data. TV weather maps presented with the evening news, on the other hand, are generally based on the most recent information released by the Weather Service, and have the additional advantage of being presented in an easily understood manner. Many include satellite pictures showing cloud patterns over large areas. Other sources of weather

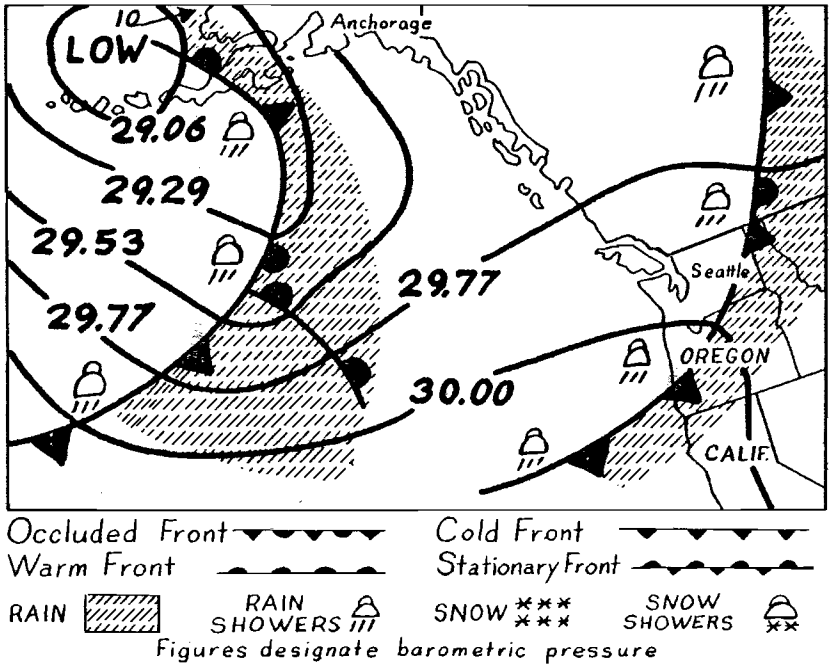

Fig. 185. Regional weather map (Seattle, May 6, 1973).

forecasts are prerecorded telephone messages and continuous Weather Service reports on the VHF-FM public-service band (either 162.4 or 162.55 MHz.). In any case, weather signs read in the clouds are more meaningful when considered in reference to recent Weather Service forecasts.

Weather at higher elevations in the mountains may be substantially different from weather observed even a few miles away in the lowlands. Low stratus clouds causing an overcast but dry day at home may be forced up mountain slopes, causing a heavy drizzle. Conversely, a cloudy, drizzly day at home may be due to low stratus clouds, or fog, with the mountains rising above this low overcast into clear, sunny weather. While it is sometimes difficult or impossible to anticipate the extent and significance of a heavy overcast, or the weather above an overcast, an aviation weather forecast may resolve these points. Aviation weather observations and forecasts are available on telephone recordings and are also broadcast on the long-wave aircraft frequencies (200-400 kHz and 108-110 MHz). They are especially helpful in identifying cloud levels.

ORIGINS OF WEATHER

In the middle latitudes, major weather patterns are the result of confrontation of cold, relatively dry polar air with warm, moist air. These air masses meet along a *front,* usually identified by clouds, precipitation, temperature change, and a trough of low pressure. Fronts are the boundaries between air masses of different densities. Low-pressure troughs develop along fronts so that pressure falls as fronts approach and rises after they pass. Wind direction shifts clockwise (veers) as a cold front passes in the northern hemisphere (in the southern hemisphere, the wind shifts counterclockwise).

Most important weather changes usually accompany cyclonic storms associated with frontal waves. Development and dissipation of a cyclonic storm is illustrated in Figure 186. As the storm (frontal wave) develops, cold air pushes under a warm air mass, while the displaced warm air rides over the cold air mass. The cyclonic frontal pattern of Figure 186 is characterized by wind movement counterclockwise around a low-pressure center. Winds follow approximately the direction of the isobar lines (isobars connect places of equal barometric pressure), so that the location of the low-pressure center can be estimated from the wind direction. In the mountains, unfortunately, surface winds are often unreliable indicators and upper-level clouds must be relied upon to indicate wind direction. An easily remembered generalization is that in the western United States southerly winds preceed and accompany most storms.

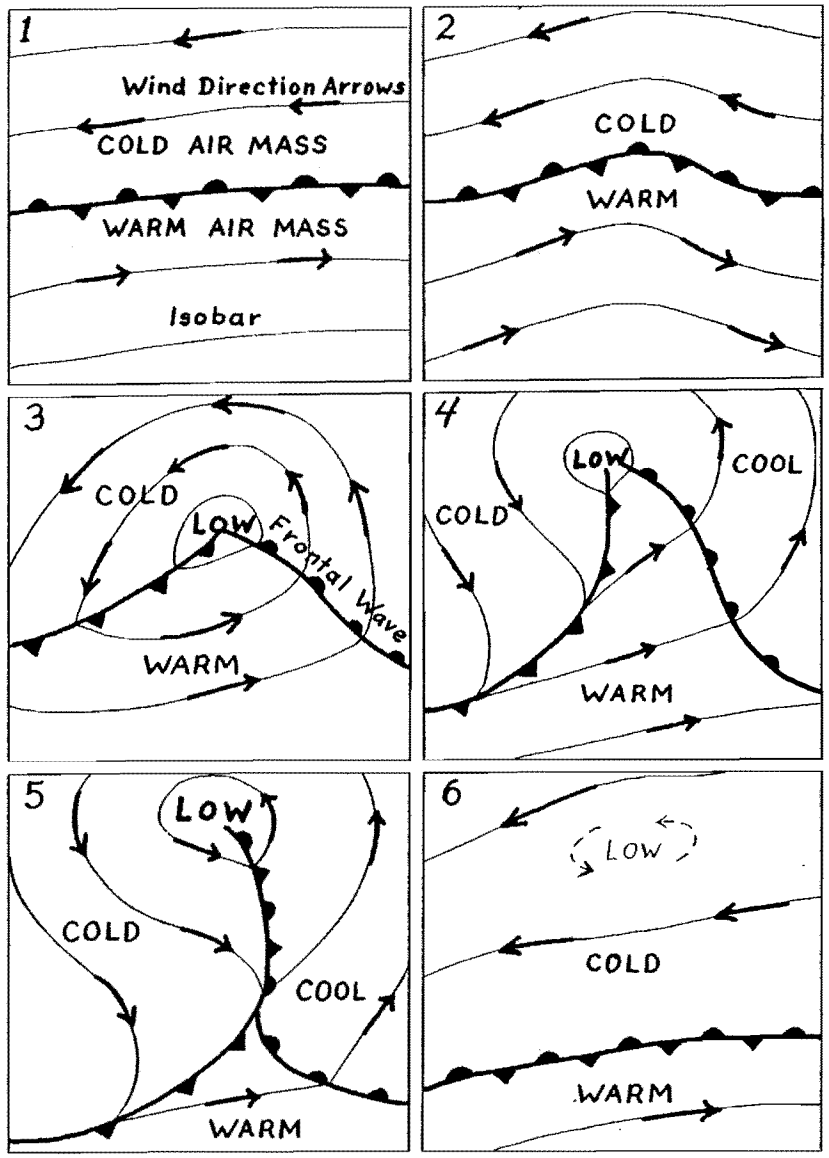

Fig. 186. Development and dissipation of a cyclonic storm cell.

Because a cold front travels about twice as fast as a warm front, the cold front ultimately overtakes the warm front, becoming an occluded front. This is the final stage before dissipation of the cyclonic weather pattern.

FORECASTING WITH CLOUDS

The best way to forecast weather in the mountains, as previously mentioned, is to start at home by reviewing the latest weather maps and Weather Service forecasts. Armed with knowledge of the general weather pattern, the mountaineer is better prepared to predict local weather several hours in advance by observing cloud types, pressure changes, and wind direction. Clouds indicate what is going on in the atmosphere, always demonstrating that a layer or body of air has cooled before its dew point so that some of its vapor has condensed into liquid or solid form. This moisture becomes condensed in only two ways: air, with invisible water vapor contained therein, must be lifted and thereby cooled until the vapor condenses, or there must be horizontal countercurrents of air of different temperatures. By contact, the warmer air is cooled and clouds form. Clouds tend to repeat themselves in familiar patterns because atmospheric processes tend to repeat themselves, giving visible evidence in the clouds.

Cloud Types

Clouds are defined by their appearance as belonging to the *cumulus* family, with a billowing shape, or to the *stratus* family, with pronounced stratification. The two varieties are further classified by their altitude.

Cirrus clouds, formed of ice crystals, are at very high altitudes, usually 20,000 to 35,000 feet in the middle latitudes. They can give 24 hours warning of approaching bad weather hundreds of miles in advance of a warm front. Frail, scattered tufts are a sign of fair weather, but prognostic types, such as mares' tails or dense cirrus bands, may be a prelude to approaching lower clouds and finally the arrival of precipitation and the front.

Alto-family clouds are the middle clouds, extending from about 8000 to 20,000 feet. Altostratus sheets or veils and altocumulus clouds should be observed for indication of approaching bad weather. When these thicken, especially if preceded by prognostic-type cirrus, precipitation within 6 to 10 hours is probably indicated.

Stratus clouds are low-level clouds, ranging from the earth's surface to about 8000 feet. If they reach the ground they become fog. Mountaineers frequently find the heavy overcast in the morning is low-lying stratus, or valley fog, which is left behind after a few hour's climbing brings the party

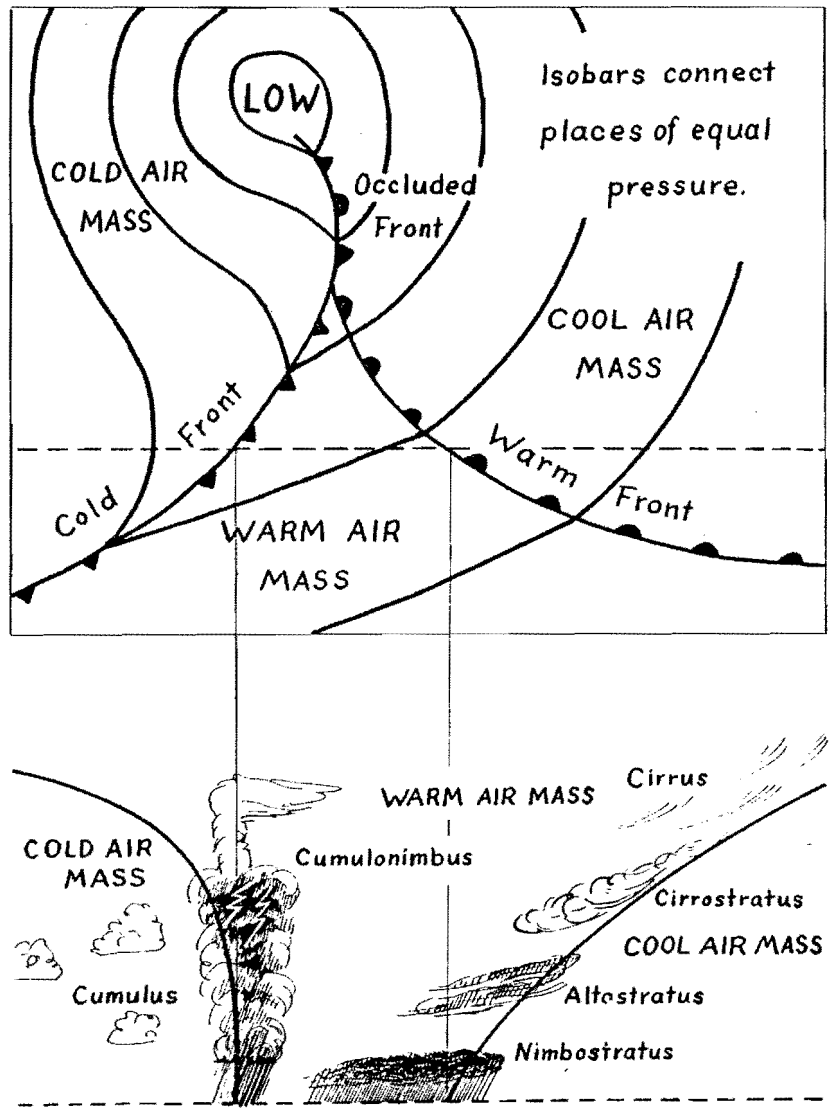

Fig. 187. Mature cyclonic storm. *Top*, horizontal profile. *Bottom*, vertical profile taken along dashed line in upper illustration.

to upper slopes bathed in sunlight. *Nimbostratus* is the cloud that yields steady rain.

Cumulus are tall clouds with vertical development, formed in moist, unstable air. Cotton puffs of cumulus are fair-weather clouds but should be observed for possible growth leading to *cumulonimbus*, or thunderstorm clouds. Great amounts of energy are released in a cumulonimbus cloud as strong updrafts carry moist air upward for thousands of feet to be condensed, yielding heavy precipitation as snow, rain, or hail. Cumulonimbus activity is typically associated with cold fronts and can occur at any time of year, although more common in summer. Cumulonimbus also form along ridges or peaks on summer afternoons. Some mountains are more prone to produce afternoon thunderstorms and in some areas of the Rocky Mountains, for instance, prudent climbers get an early start to assure being off the peak by the time the afternoon thunderstorm develops.

Cloud caps sometimes form above prominent peaks, indicating moisture aloft. A cloud cap is not of immediate concern unless it is descending on the climbing party's objective; in this case a cold and windy summit can be anticipated. A growing and descending cloud cap foretells approaching bad weather. High winds can produce a *lenticular cloud banner* extending downwind from a peak or ridge, sometimes for several miles; such phenomena should also be watched for indications of worsening weather.

Cloud development should be observed over a period of time to reduce confusion over misleading patterns. When winds are due to circulation about high or low-pressure centers and not due to mountain or valley winds or land or sea breezes, typical weather patterns can be generalized in cloud orientation rules. These rules apply only in the northern hemisphere and are subject to variation due to local weather patterns.

Cloud Orientation Rules

1. High or middle clouds moving from the south are an indicator of deteriorating weather. Movement from the north indicates fair weather (except possibly under an arctic air mass in winter).
2. Low clouds moving from the south indicate deteriorating weather, especially if moving fast. Movement from the north indicates fair or improving weather.
3. When clouds are absent, a strong north wind indicates fair weather.

LOCAL WEATHER PATTERNS

Local weather patterns tend to complicate weather prediction in the mountains but are an important part of local mountain lore. Familiarity

with local weather can contribute substantially to the success of a climb. In fact, it is almost impossible to accurately predict weather in the mountains without knowledge of local orographic or terrain effects.

Regional weather patterns can be determined by consulting local meteorologists. Any climber in the Tetons, for instance, should be aware of the predictable afternoon thunderstorm and plan his schedule to be off the summit before lightning strikes. Winter climbers in New Hampshire's Presidential Range are apprehensive of a northeaster bringing in moist air off the Atlantic resulting in heavy snowfall, an apparent exception to the cloud orientation rules. Climbers in the Cascades frequently find that dreary, rainy weather on the western slopes can be avoided by selecting an objective on the sunny eastern side of the range.

Seasonal weather variations are also of interest. Major Himalayan ascents are frequently timed for the brief period between severe winter storms and the summer monsoons bringing storms off the Indian Ocean. Weather in the Cascades, while generally sunny for several days at a time in summer, frequently has rapidly moving fronts passing through almost daily in winter, almost twice as fast as in summer. Summer weather in the Cascades, although generally predictable, is subject to occasional thunderstorm activity, indicated by middle and high clouds of moist, unstable air moving out of the south or southeast.

A weather phenomenon observed wherever winds must pass over mountains is *adiabatic cooling and heating* of the air. As an air mass is lifted over a mountain range, it is cooled due to decreasing pressure; as it descends the other side of the range, it is warmed due to increasing

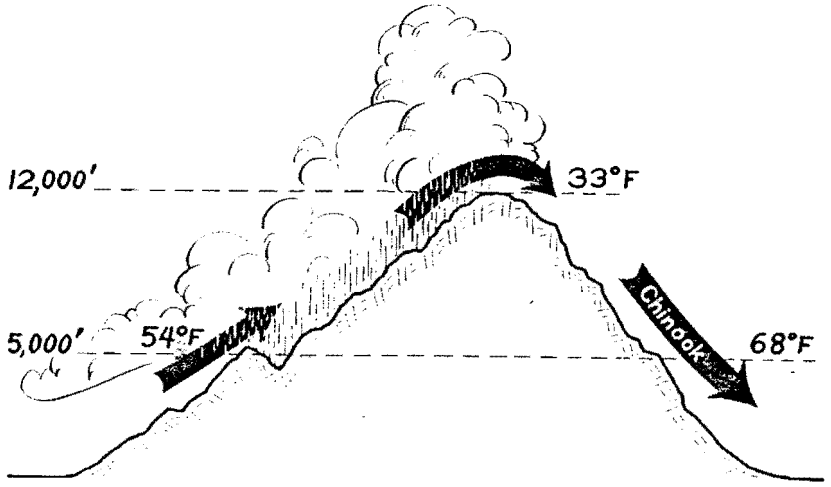

Fig. 188. Example of adiabatic lapse rate in an air mass moving over a ridge.

pressure. The drop in temperature with altitude, or dry adiabatic lapse rate, is about 5°F for each 1000 feet. If precipitation accompanies the elevation gain, heat given up to the air through condensation of water vapor reduces the adiabatic temperature drop to about 3°F per 1000 feet.

Knowledge of the adiabatic lapse rate is useful in estimating clothing and equipment suitable for the colder temperatures encountered at a higher elevation. For example, if rain is falling and the temperature is 41°F at one location, the rain will turn to snow about 3000 feet higher. A 15,000-foot summit may be 25 to 40°F cooler than the trailhead at 5000 feet. On the other hand, a temperature inversion may occasionally produce relatively warm temperatures on a lofty summit.

Chinook winds are a peculiar occurrence resulting from adiabatic cooling of moist air ascending a mountain barrier followed by adiabatic warming as the air descends the opposite side. The temperature drop of the ascending air is reduced due to heat released by condensing water vapor. However, when this air mass descends the leeward slopes, it still gains 5°F per 1000 feet of descent. Therefore, there is a net temperature gain at the base of the leeward slopes. If the quantity of precipitation released on the windward side is large, the temperature on the leeward side is considerably warmer.

Mountain and valley winds are a local weather phenomenon. As the sun warms the slopes, the air near the ground is heated and rises, creating an "upslope canyon" wind; but as the sun descends and the slopes cool, the cooling air flows back down the canyons into the valleys. Temperature changes and moderate winds may be experienced in the paths of mountain and valley winds. They generally pose little problem except for confusing attempts at recognizing the real wind pattern. This is especially true near mountain passes where winds attempting to cross the mountains are funneled through the path of least resistance, frequently with increased wind speed and change of direction.

FURTHER STUDY

The study of weather is a complex science, involving a composite of the net effects of multiple contributing factors. Even professionals are so frequently frustrated by its vagaries it is rumored they resort to dart-board forecasting.

It should be apparent that one short chapter can only briefly generalize about mountain weather and its prediction. As a practical matter, however, using the preceding information and the actual evidence around him during the approach and while gaining a peak, but *before* the start of any technical difficulties enable the climber to decide whether or not to go on in the face of developing weather.

Supplementary Reading:

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(26)

COLLECTIVE REVIEW

(8)

First-Aid Treatment of Poisonous Snakebite: Are Currently Recommended Procedures Justified?

*Morgan E. Stewart, MS**
*Sander Greenland, MS, DrPH**
Jerome R. Hoffman, MD†
Los Angeles, California

A survey of the literature on first-aid treatments for poisonous snakebite reveals conflicting recommendations. A subsequent review of experiments and case surveys investigating such treatments indicates that the most commonly recommended procedures (incision and suction, ligation, and ice-packing of the bite) are not well supported by experimental evidence, and may possibly be harmful. We suggest that further clinical research and case studies are necessary in order to determine safe and effective first-aid procedures for the bites of American poisonous snakes. Stewart ME, Greenland S, Hoffman JR: First-aid treatment for poisonous snakebite: Are currently recommended procedures justified? *Ann Emerg Med* 10:331-335, June 1981.
bites, snake

INTRODUCTION

Although poisonous snakebite is not a common event in this country, the growing popularity of outdoor activities makes it likely that an increasing number of people will seek information on what first-aid procedures, if any, should be followed in the event of a bite. Unfortunately, recommendations in current medical writings are contradictory. A survey of American literature for the period 1970 to 1979 yields the following advice:

1) Catch the snake and kill it; bring it with you to the hospital;[1]
2) Get away from the snake as fast as possible to avoid the risk of additional bites;[2]
3) Apply a tourniquet proximal to the bite;[1-8]
4) Always loosen the tourniquet every 10 minutes;[9]
5) Never loosen the tourniquet until arrival at the hospital;[7]
6) Never use a tourniquet;[10]
7) Pack the bitten extremity in fresh-water ice;[11]
8) Never pack the extremity in ice of any kind;[1,3-5,10,12-14]
9) Splint the bitten extremity;[1-3,7,10,12,15]
10) Immediately apply incision and suction to the bite;[2-4,7-9,15]
11) Do not attempt incision and suction;[6,11,12,16]
12) Keep moving to encourage spread of the venom from the wound and minimize bite site necrosis;[17]

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Dr. Greenland's work is supported by a grant from the Milbank Memorial Foundation.

Address for reprints: Jerome R. Hoffman, MD, Department of Medicine, UCLA Hospitals and Clinics, Center for the Health Sciences, Los Angeles, California 90024.

13) Avoid all unnecessary movement.[18]

Specific first-aid techniques are recommended without reference to controlled research. Many authors claim their advice is based on clinical experience, but in the absence of reported quantitative data, such contradictory experience is difficult to evaluate. We decided to review original research articles to determine which first-aid techniques are effective in reducing mortality, morbidity, and disability following snakebite. Our citations are limited to all experimental studies involving American snakes and several of the most important clinical case studies.

In the United States, the overwhelming majority of poisonous snakebites are due to pit-vipers (specifically, rattlesnakes, copperheads, and moccasins); it is thought that pit-viper bites are more likely to result in permanent disability than are the bites of coral snakes.[10] In addition, we found no experiments involving coral snake venoms in the American literature, and could draw no conclusions from case series because of the rarity of coral snake bites. Our review concentrates on the treatment of indigenous American pit-viper bites. A large body of literature exists pertaining to the treatment of bites by other viper species; however, because it has been shown that the chemical make-up of viper venom may vary among species,[3,4,9,19-22] no attempt is made to extrapolate from data based on species which are not indigenous to this country.

THERAPY

It is difficult to evaluate the efficacy of snakebite treatment on the basis of clinical experience alone. Venomous snakes inject variable quantities of venom during any particular attack.[23] Thus outcome in any small number of individuals may be related to the unmeasured variation in the amount of venom each victim received, rather than to the efficacy of a mode of treatment. Significant information about the value of specific treatments could, therefore, only be gathered from comparisons of extremely large numbers of patients, where variations in the severity of the envenomation could be expected to even out. No large, controlled studies of specific snakebite treatments have been reported. Because an anecdotal review is based on ill-defined clinical impressions of general changes in morbidity related to intermittent use of various combinations of treatment modalities, even a large review would be insufficient to lead to definitive conclusions about the efficacy of any particular treatment.

Many traditional first-aid measures are based on the concept that it is best to prevent systemic spread of venom from the involved extremity. While this theory has not been verified, it is ostensibly based on the fact that systemic effects of envenomation carry a real threat of mortality, while local effects of venom, though potentially very injurious, are not life-threatening. Conversely, antivenin therapy, the hallmark of snakebite treatment, is demonstrably effective in antagonizing systemic effects of envenomation and decreasing local sequelae in cases in which extensive vascular damage has not occurred prior to its administration.[4,23]

At least one author has argued that it may be preferable to avoid concentrating the venom in the affected extremity, allowing it instead to diffuse into the systemic circulation where its effects can be antagonized by antivenin administration.[17] Theoretically, this provides a rationale for treating patients differently on the basis of whether there is early availability of antivenin: while first-aid measures which effectively contain the venom in the bitten extremity may be useful when significant delay is expected before antivenin administration, these measures should be avoided when access to antivenin therapy is expected to be prompt. There are a number of studies demonstrating that various techniques do in fact limit systemic spread of venom. This, in itself, does not answer the question of whether such limitation of spread lessens or increases morbidity and mortality.

Incision and Suction

The work of Dudley Jackson and his associates[24-27] represented the first attempt to evaluate experimentally the nostrums then advocated as snakebite "cures." Jackson's papers purported to provide evidence that incision and suction decreased the case fatality rate in dogs injected with rattlesnake venom, and have been extensively cited as the final authority on the effectiveness of incision and suction.

Jackson[24-27] stated that a chief objective of the incision and suction techniques is to retrieve enough venom from the wound so that the remainder can be neutralized by the antivenin. At the time of his experiments, antivenin was routinely administered intramuscularly, which limited the total amount of antitoxin that could be absorbed in time to counteract the systemic effects of the venom. Since the 1960s, antivenin has been given intravenously or intra-arterially,[7,20] thus allowing effective neutralization of even a large venom dosage.

More recent animal studies[28-33] of incision and suction have used experimental protocols substantially different from Jackson's, making comparisons difficult. Several of the reports[28,30,31] are written in anecdotal style, with no tabular or quantitative presentation of results or discussion of methodology. Although four articles[28-31] reported that prompt incision and suction (within 15 minutes of venom injection) resulted in the removal of a significant amount of venom, none showed a clear-cut improvement in survival following this technique, and two studies found a decrease in survival time among suction-treated rabbits.[28-32,34-36] The largest reported clinical series[37] involving observation of 104 envenomated human victims, some of whom were treated with a combination of constriction band and incision and suction, suggested a less severe course for these treated victims than for victims having no first-aid. The method of incision may have some relevance to possible deleterious consequences. Cruciform incisions can produce necrosis at their crossing secondary to compromised blood supply, and experimentally, wounds treated with cruciform incisions become subject to anaerobic contamination and infection.[31]

Attempts to evaluate the efficacy of any therapy, including incision and suction, on the basis of clinical response are difficult to interpret. Because early incision and suction has been shown to remove a significant amount of venom[29] (which is capable of producing symptoms in animals subsequently injected with it),[24,25,43] there may be value to this technique, at least if prompt antivenin therapy is not available. Shallow linear incisions are probably safest, and may still increase the amount of venom removed.

Ligation (Tourniquet, Constriction Band)

Some advocate the tourniquet as an adjunct to incision and suction, or as an effective first-aid measure in itself.[1,9,19,25,30,31,34,38,41] Use of the tourniquet is the single most common recommendation for viper bite first-aid found in the recent literature.[1-5,7-9,14] Emphasis is placed on impeding lymphatic return from the bitten extremity. While restricting the venom to the wound site may make intuitive sense (especially when the victim is alone and must get to an emergency department under his own power), the possibly destructive effects of the confined venom deserve consideration.

Of studies which investigated the tourniquet used alone, only three animal studies provided quantitative results. Pope and Peterson[38] reported that use of a tourniquet in dogs increased survival time at the cost of severe necrosis of the envenomated limb. Snyder et al[30,31] found that venom spread from the bitten site in a dog at rest was reduced from 22% to 9% by the immediate application of a tourniquet. They also reported[30,31] that for the combined techniques of ligation, cryotherapy, and immobilization, release of the tourniquet and removal of the ice led to rapid spread of venom from the bite site (venom was "pumped" from the wound). Among case reports, Allen[39] concluded that ligation was contraindicated, Andrews et al[19] recommended the tourniquet, and Sabback et al[8] made no specific statements for or against ligation.

Unfortunately, animal studies of the tourniquet do not approximate the situation expected to occur in a human being. In virtually all cases of human snakebite,[44] a tourniquet would be applied only as a temporary measure to retard the onset of systemic effects until antivenin could be administered. Thus the detrimental effects of prolonged tourniquet use in animals should not necessarily lead to the conclusion that short-term emergency ligation is contraindicated. Despite the limited evidence from human outcomes, the best available data suggest that use of a constriction band during the period prior to antivenin administration, without periodic removal, is effective in limiting systemic absorption of the venom.[19] Ligation may be useful in the prehospital period, particularly if hospital treatment cannot be obtained quickly. However, limited systemic absorption may occur at the expense of increased local morbidity because of increased venom concentration in the affected extremity.

Cryotherapy

Cryotherapy (ice-pack application or ice-water soaking of the bitten area) was originally proposed (Stahnke HL: The L-C treatment of venomous bites and stings. Privately published, 1953) as a definitive treatment modality which could be initiated as a first-aid measure and continued for extended periods under medical supervision. Proponents of cryotherapy argued that cold, particularly freezing, inactivated crotalid venom, and that such inactivation *in vivo* over extended periods of time (six days was the recommended period) allowed the body's defense mechanisms to destroy the venom.

Cryotherapy was the subject of controversy during the 1950s and 1960s. Venom cannot be inactivated by cold or destroyed by the body's defense system, and cooling of the tissues merely increases their vulnerability to venom-induced necrosis.[40] Of five controlled animal studies involving cryotherapy (either alone or in combination with ligation, antivenin, restriction, or amputation), none presented quantitative results, but nearly all condemned the use of cooling techniques as first-aid or as definitive treatment.[13,29,40,41] For example, Ya and Perry[41] found that a combination of tourniquet and cryotherapy increased survival in dogs when antivenin administration was delayed until four hours or eight hours after venom injection, but only at the cost of extensive damage to the envenomated limb. They also found that cryotherapy did not reduce mortality to a level comparable to that of the group that received antivenin with 30 minutes of venom injection and no local measures. The general discredit of cryotherapy is reflected in current (1970-1979) literature: of the 13 general articles on first-aid for pit-viper bites that we reviewed, only one recommends cryotherapy, and then only if administered by a physician.[11]

Other First-Aid Treatments

Based on current evidence, it is possible that certain other first-aid procedures are unlikely to be detrimental, even if their beneficial effect has not been demonstrated. The first of these is putting the victim at rest (sometimes referred to as "inactivity" or, in experimental animals, "restriction"). Most of the current literature recommends immobilization of the bitten extremity,[4,5,14] or splinting.[1-3,7,10,12,15] Research results are less definite, but favor restriction. Leopold et al[31,33] reported that restriction of movement significantly increased survival time in rabbits. Emery and Russell[42] reported no benefit from restriction in mice. Snyder et al[31] noted that inactivity reduced the percentage systemic uptake of isotope-tagged venom in dogs. McCullough and Gennaro[18] reported much more severe hospital courses in patients who demonstrated moderate to extreme activity after envenomation, as opposed to generally milder courses in a larger number of victims who received early immobilization.

Many of the studies of tourniquet and incision/suction used these techniques in combination with restriction of movement. If a goal of first-aid is to retard systemic envenomation without dramatically concentrating venom in the affected extremity, inactivity (where practical) may represent a compromise between active measures (such as ligation) and no first-aid.

A second technique which may be expected to have no harmful effects is suction without incision. Jackson's first study does not specify that incision was used in the majority of animals he treated by suction; all other experimental studies[25-34,36,38,41,43] used incision as well as suction. Because the venom was injected by syringe in these studies, the small diameter of the puncture made incision necessary in order to get access to the deposited venom. In cases of actual viper bite, it may be possible to remove some venom by suction without making incisions. In the case survey by Sabback et al[8] of bites to human beings, it is unclear whether incision was carried out whenever suction was applied. In any case the small number of cases examined in their report make it impossible to draw conclusions about the usefulness of suction alone.

DISCUSSION

In evaluating the experimental studies, several points must be kept in mind. It may not be appropriate to generalize results of animal studies to man. As pointed out by Russell and Emery,[43] small species may be adversely affected by incision to a point at which their survival time is

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reduced, while such an effect may not occur in man. In addition, a human being bitten by a pit-viper is usually able to reach an emergency department relatively quickly, and often within an hour or two of the bite.[5,44] Most of the animal researchers assume that local therapy is all that is available. Only a few studies (eg, Ya and Perry[41]) examine ligation, incision/suction, and inactivity as true "first-aid" measures, that is, consistently followed by antivenin administration.

Nearly all the experiments[29-32,34,36,40-43] involve injection of *Crotalus adamanteus* (Eastern diamondback) venom, a hemolytic toxin. While simplifying the experimental analysis and facilitating inter-study comparisons, this also limits the generalizations that can be made. The effects of venoms differ from species to species, and even from snake to snake.[3,4,22,38] In many cases of pit-viper bite in the field, the species of snake cannot be identified. Because of this problem, any recommended first-aid procedure for the United States should be appropriate for treatment of the bite of any native pit-viper species.

Bites of elapid species (eg, coral snakes) are rare in the United States.[1,2,5,19] The venom of these snakes is neurotoxic[45] and is disseminated through the bloodstream rather than the lymphatic system;[15] thus, first-aid recommendations for elapid bites probably should not be based on the experiments discussed above. Clinically based recommendations for the treatment of coral snake bites are contradictory, but incision and suction are generally thought to be useless,[15,37] while a tight tourniquet is recommended only in cases in which medical help is not immediately available.[15,18,24,37]

Estimates of the annual incidence of pit-viper bites in the United States are between three and four per 100,000.[3-5,9,15,16] It is probably because of the relative rarity of such bites that no large case studies of first-aid techniques have been performed. To carry out a thorough case study, it would be necessary to collect several thousand case reports of bite victims; stratify the data by age, snake species, first-aid techniques, treatment, grade of bite, and outcome; and do a multivariate statistical analysis of the relationship of first-aid procedure to outcome. Although this would be an expensive undertaking requiring the cooperation of many hospitals, it may be worthwhile: post-bite disability rates as high as 58% have been reported,[4,10,15,16] a statistic of particular importance because the typical bite victim is young.[5,7,8,14,16]

CONCLUSIONS

To date, none of the first-aid procedures commonly recommended in the literature has been shown definitively to reduce mortality or disability from pit-viper bites. In addition, some of the procedures (incision and suction, tourniquet, cryotherapy) may be harmful in commonly encountered situations. Splinting of the bitten extremity, suction without incision at the bite site, and avoidance of unnecessary exertion may have some first-aid benefit. However, based on current literature, the single undisputed and most necessary course of action following pit-viper bite is rapid transport to an emergency department, because intravenous or intra-arterial administration of antivenin remains the definitive therapy and the only therapy of proven value.

Emergency physicians should be aware of the potential dangers associated with many popular first-aid techniques. We suggest that large-scale, cooperative, prospective clinical studies be organized in order to define more clearly the indications and/or contraindications for first-aid snakebite treatment measures.

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Comments on Snakebite by Keith Conover:

1. Unenvenomated snakebites don't need treatment for poisoning.
2. Pit Viper venom is not poisonous when taken by mouth, but the use of oral suction guarantees a serious infection.
3. Any incisions (OF THE INCISION.) should be linear, along the normal planes of the tissue and along the long axis of limbs to minimize scarring and damage to nerves and tendons.
4. Don't use the cut-and-suck method on the hands, feet, face, or genitals unless you know exactly what you're cutting and the consequences.
5. Remember, the greatest danger is to limb rather than life.

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TREATMENT OF A MILD CONCUSSION

BY JOHN K. WILEY, MD

A concussion, as you no doubt know, is a head injury that causes brief unconsciousness followed by a return to normal consciousness. If your neighbors and friends haven't already asked your advice about a mild concussion, chances are they will, because concussions are, by far, the most common head injuries.

A typical case would be an 8-year-old boy who hits his head and loses consciousness when his bicycle skids on a patch of ice, throwing him to the pavement. By the time his parents or friends reach him, he'll be alert and oriented, with no obvious injury except his scratches.

If his reaction is typical, he'll vomit a few times after the head injury and then, tired out by his crying and vomiting, he'll try to fall asleep. And that's the point at which his family will probably call you. *Should they take him to a doctor? Does his vomiting mean he's seriously ill? Shouldn't they keep him from falling asleep?*

The chance that the boy is seriously injured is slim. Still, if someone asked me about the need to see a doctor, I'd give this advice: "Your son is probably fine, but there's always a very slim possibility of serious injury with any fall that causes a loss of consciousness. If he were my son, I'd have someone check him over."

The other questions are easier to answer. The vomiting doesn't have any prognostic significance: Children who hit their heads usually vomit (adults less often), and it doesn't tell us anything about the severity of the injury.

The question about sleep should be answered this way: "There's no need to keep your son awake, but you should check him at least every hour to be sure you can wake him easily, that his pupils are of equal size, and that he's moving his arms and legs well."

The parents' judgment during these hourly evaluations is obviously key: Why is the boy harder to awaken at 3 than he was at 2? Because he's getting so tired, or because the fall has caused brain edema? Is his grip weaker with his left hand because he's right-handed or because a blood clot is pressing on his brain?

Because most parents don't have the judgment to answer these questions, I recommend that people with concussions be admitted to the hospital, where their level of consciousness can be observed and evaluated by nurses skilled in this role.

THE SCREENING NEUROLOGICAL EXAMINATION

Most children with mild concussions, like the 8-year-old I mentioned, are sitting on the examining table, swinging their legs, talking, and being inquisitive when the doctor or nurse arrives to examine them. *Adults* with minor concussions are usually a little sicker. They may display irritability or other personality changes; they may complain about their pain out of proportion to their actual injury; or they may just seem to lack spontaneity.

Whatever their appearance, a screening neurological exam has two purposes: to determine whether the fall has caused any unsuspected neurological defects; and to document the patient's condition so that any changes can be evaluated.

For a fuller description of the neurological examination, I recommend CLINICAL EXAMINATIONS IN NEUROLOGY (4th edition) by the Mayo Clinic and Mayo Foundation, W. B. Saunders, 1976. But here are the basics:

- Start with a mini-mental status examination. Notice whether the patient is acting appropriately to the situation. Is he alert, oriented to person, place, and time?
- Find out which hand is dominant to determine the patient's normal cerebral dominance.
- Examine the function of the 12 cranial nerves:

First cranial nerve. Ask the patient to identify something by its smell.

Second. Ask him to identify something by looking at it, and check his eyes for papilledema.

Third, fourth, and sixth. Check pupil size and reactivity to light. Check for extraocular movement: Do the eyes move together in all directions of gaze?

Fifth. Check for facial sensation on both sides.

Seventh. Check for facial movement on both sides.

Eighth. Check hearing in both ears.

Ninth and tenth. Check swallowing and gag reflex.

Eleventh. Check for symmetrical head movements.

Twelfth. Check tongue movements by asking patient to protrude his tongue or by listening to him talk.

- Check motor function. Ask the patient to move all extremities and note asymmetrical movements. If the patient can walk, ask him to walk on his toes and then on his heels. Ask him to squeeze your hand, checking for symmetrical strength.
- Check cerebellar function by asking the patient to touch his index fingers to his nose with his eyes closed. Check Romberg's sign (the patient starts to fall when he stands with his eyes closed and his feet together), deep tendon reflexes, abdominal reflexes, and Babinski's reflex. As with other checks, your main interest is to detect asymmetry.
- Take skull and cervical spine X-rays.

BRIEF OBSERVATION

If the findings of the neurological examination are normal (and they usually are in mild concussions), the patient will be admitted for observation for 24 hours or until irritability and other signs of injury disappear.

Usually, no medical treatment is ordered. The patient may eat and drink what he wishes, and adult patients may have aspirin for headache. (Children usually don't complain of headache.)

The purpose of hospitalization is systematic, scheduled observation by a nurse with experience in assessing neurological function. Although the chance of finding dysfunction in these patients is small, the nurse's role is crucial to those few patients who do develop severe edema or a mass lesion.

evacuation

The determination of when to evacuate and whether it should be done by the party or by outside help is a difficult problem. It depends not only upon the condition of the victim but upon the following factors:

1. Number in the party and their condition
2. Location of the party — miles from help
3. Time of day
4. Weather — current and expected
5. Terrain — snow, rock, trail
6. Supplies and experience in the party
7. Reaction time of the help and their technical competence

Obviously, then, the answer to "when" and "by whom" varies drastically from case to case. There are, however, some generalizations that can be made.

When to evacuate

A victim should be evacuated as soon as possible by whatever means available and compatible with his injuries. The longer the delay, the greater the chance of infection and the more difficult surgical repair becomes. His condition, however, should not be compromised in the effort. Since he normally will benefit from a period of rest following the injury, no transportation should be considered until his condition has stabilized. This is best indicated by the victim himself. He should be asked how he feels and his condition closely observed prior to and during transportation. **ONLY** UNDER LIFE-THREATENING CONDITIONS CAUSED BY INJURY, WEATHER OR TERRAIN SHOULD EVACUATION BE IMMEDIATE. In fact, in some injuries, evacuation is best DELAYED until rescue personnel and/or medical assistance is available.

Seldom should the party consider evacuating an injured individual under their own power. The trauma associated with transportation over difficult terrain (including narrow trails) with improvised devices is usually an unnecessary burden on the victim and exhausting to the party. The party saves no time in evacuating a victim off a terraced ridge to a valley floor only to have a helicopter pick him up there. In that instance, the victim's

condition is only aggravated, and an additional strain placed on both him and the rest of the party.

There are some exceptions to the above. Evacuation by the party may be considered for injuries that are not major (e.g., a closed fracture of the lower leg or arm), if the accident has occurred near a trail, if the party is strong and sufficiently large (12 or more) to perform the carry adequately, if the distance is less than 3 to 5 miles, AND if the victim's conditions and spirits allow such a move. In other conditions, however, if the accident has occurred in an area requiring technical evacuation (that which requires lowering), where injuries are severe, where distances are extreme OR the party size and/or strength are not sufficient for the carry, evacuation should NOT be attempted. Rather, it is better to wait for assistance. Again, it may not only be easier on the victim, but faster to await possible helicopter pick-up than to attempt evacuation over difficult or lengthy terrain.

EVACUATION SUMMARY CHART

WHEN	UNDER WHAT CONDITIONS
EVACUATE IMMEDIATELY	If victim exhibits symptoms of a major head injury, OR If pulmonary edema is suspected, OR If victim has prolonged unconsciousness, OR If weather or terrain conditions are life-threatening.
DELAY EVACUATION until rescue personnel and/or medical assistance is available	If victim exhibits symptoms of apoplexy, heart attack, internal injuries, neck or spinal fracture, OR of skull fracture.
EVACUATE ROUTINELY BY PARTY	If victim has NOT sustained major injury, AND If party is strong, large, and knowledgeable, AND If the distance to road by trail is less than 3 to 5 miles, AND If the victim's condition is stable and strong.

Evacuation of party members

After it has been decided whether the victim should be evacuated, another question remains: Should some of the remaining members of the party be evacuated? If, for example, some are not prepared for a bivouac situation or have given most of their equipment to the victim, it is better that they leave the accident scene for civilization rather than risk the problems associated with hypothermia, exhaustion, inadequate food consumption, etc. If this decision is made, it is well advised to:

1. Provide first aid, shelter and food to the victim first.

2. Leave the stronger and better equipped members with the victim together with extra food clothing, fuel, etc.
3. Send the remainder of the party down the mountain under suitable leadership before they become victims themselves.

Preparing the victim for evacuation

If it is decided that the victim will require evacuation, regardless of the method, he must be mentally and physically prepared for the move. He should be informed how the evacuation will be conducted and what he should expect. Initially, he should be handled with UNREASONABLY EXTREME CARE until his confidence in the evacuation techniques outweighs his desire to evacuate himself. The first aiders should expect an increase in the victim's pulse, respiration and blood pressure as an indication of his anxiety.

Once mentally prepared, he should be placed into the litter, wrapped in layers of clothing and plastic as appropriate, and securely tied in. It would obviously be disastrous if the victim fell out or even if an arm came undone and was stepped on. It has happened — GUARD AGAINST IT. Place on the victim a pair of goggles and hard hat so that he is reasonably protected. Additionally, conspicuously attach a chronological record of the first aid administered, particularly important if his condition has been unstable, medication given or a tourniquet applied. A duplicate record should always be kept by one of the party members having performed the first aid.

Caring for the victim during evacuation

During evacuation, observe the victim constantly. Talk to him and ask him how he is doing. Stop occasionally to let him rest. For lower extremity injuries, evacuate him with his head downhilll. For chest, head or upper extremity injuries, evacuate him feet first when lowering. Just as in the treatment of shock, carry the victim in a nearly horizontal position when possible, slightly elevating the injured area.

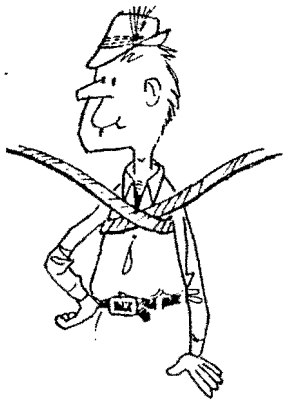
Evacuation by back carry

One method of evacuation, the **back carry**, is particularly good for transporting a victim with minor injuries of the lower or upper extremities short distances to a trail or stretcher. Its limitations are apparent: it is, most obviously, very tiring for the rescuer, and not particularly comfortable for the victim, whose circulation in the lower extremities will be impaired over a period of time.

BACK CARRY

(1)

PASS ONE INCH NYLON TAPE OR TWO INCH WEBBING ACROSS THE BACK OF THE VICTIM UNDER HIS ARMS . . .

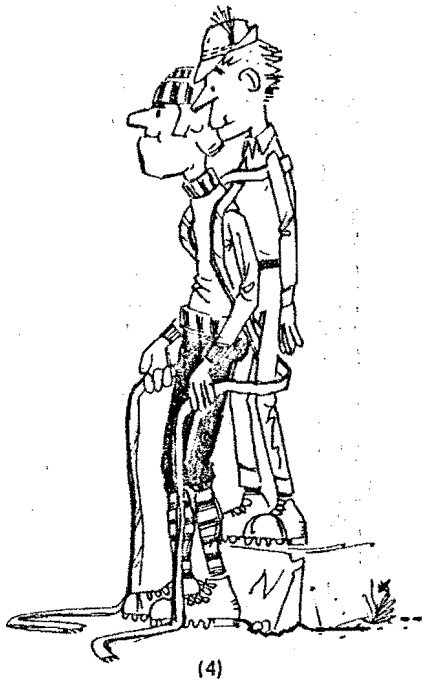


(2)

CROSSING IT IN FRONT OF HIS CHEST . . .

(3)

THEN WITH THE VICTIM AND RESCUER TOGETHER, PASS THE WEBBING OVER THE SHOULDERS OF THE RESCUER . . .



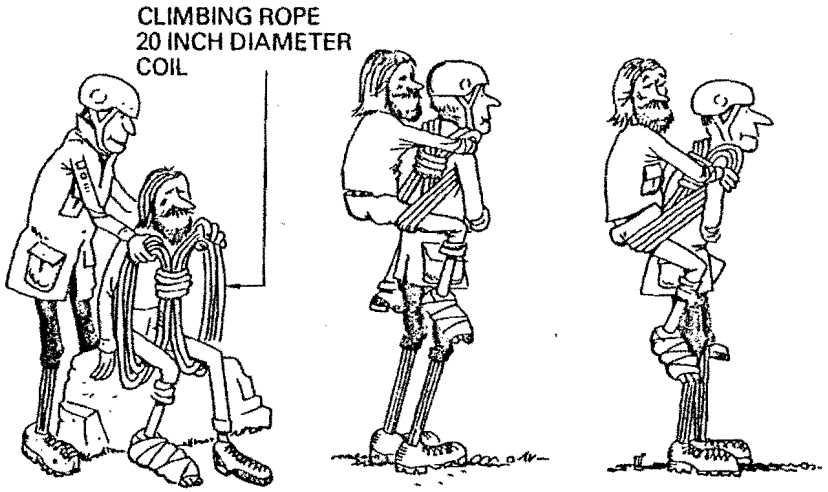
(4)

THEN AROUND THE VICTIM'S LEGS ABOVE THE KNEES . . . .

(5)

WITH THE WEBBING TIED IN A SQUARE KNOT ACROSS THE STOMACH OF THE RESCUER WITH THE ENDS TIED OFF.

If 2-inch webbing is not available, a rope seat may be constructed as an alternative. Construction requires a 120-foot climbing rope coiled into a loop 16 to 20 inches in diameter and secured tightly on one side. The coil is then divided to provide a seat for the victim and shoulder straps for the rescuer. (See following page.)

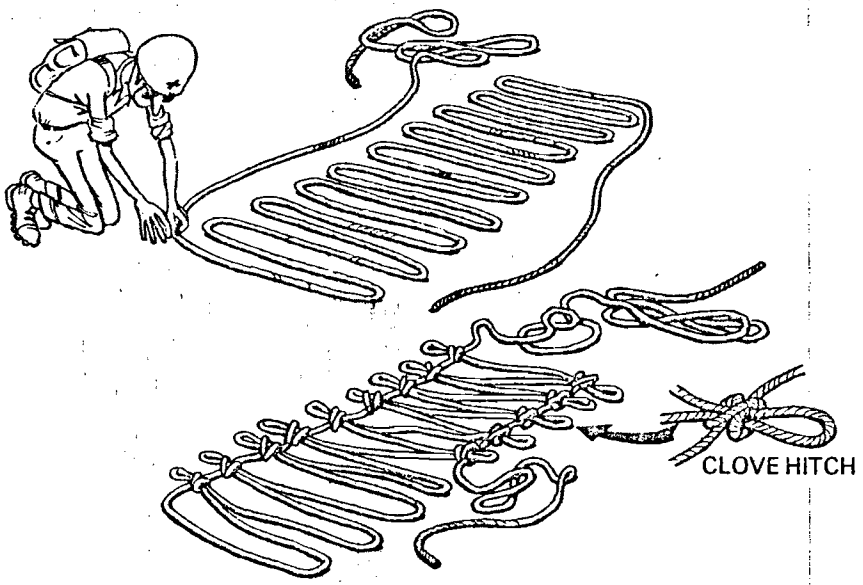


Evacuation by rope stretcher

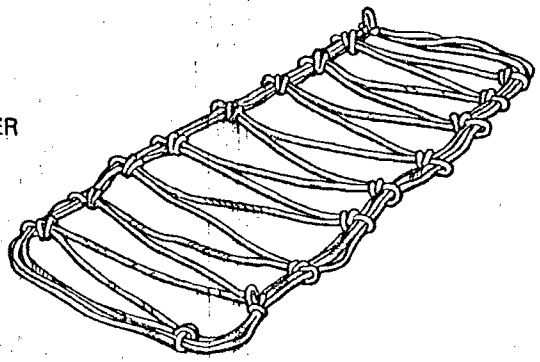
Another method of evacuation is by a **rope stretcher.** This can be constructed and used with or without the aid of ice axes and/or branches as follows.

Place the rope, preferably 150-foot, extended, on the ground. Find the center. From the center make 16 180° bends, 8 extending on each side of the center. The distance between the bends should be approximately as wide as the victim and the full 16 bends approximately as long as the victim's length. Bring the rope ends around the sides of the stretcher adjacent to the bends. Tie a clove hitch in the rope section adjacent to each bend and insert the bend. Continue tying clove hitches and inserting bends until all the bends are bound. Leave a small loop between the apex of the bend and the knot. Insert the remaining rope through the loops until the entire remainder is coiled around the stretcher. Snug up the knots, tie off the ends and insert padding from the neck to the hips. (See illustration following page.)

Someone should try out the stretcher, whether it is constructed of rope or branches, before placing the victim on it. In this way the need for additional padding or supporting material can be determined without causing discomfort to the victim. CAUTION: evacuation by rope or any improvised stretcher is usually very rough on the victim. If there is a chance that further injury will result, DO NOT EVACUATE until trained rescue personnel with proper equipment are available to assist.



ROPE
STRETCHER



Evacuation by branch stretcher

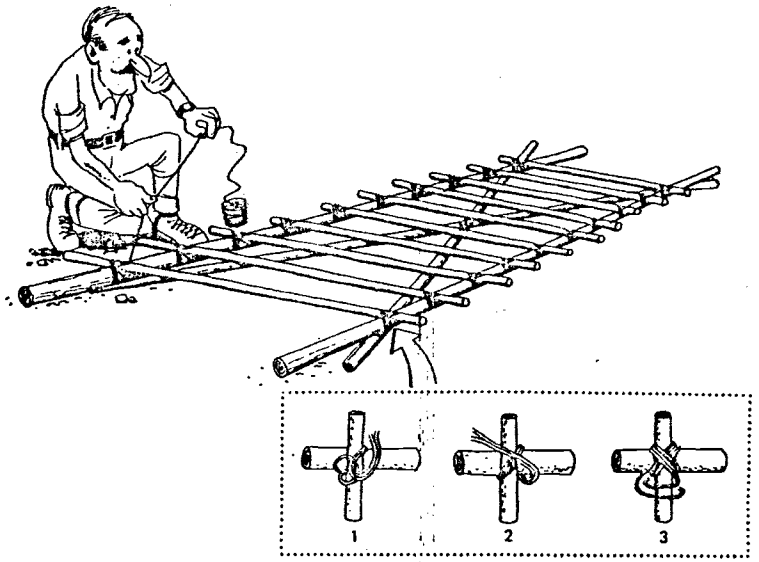
Occasionally a situation may arise in which an injury requires immediate evacuation, but outside help is distant. A branch stretcher may be the key to transporting the victim safely and efficiently. It will provide more rigidity than a rope stretcher, is easier to carry, and is more comfortable for the victim.

A branch stretcher must be constructed properly. The following procedures define the MINIMUM requirements for a stretcher capable of transporting an injured victim over about 5 miles of reasonably maintained trail. One may wish to strengthen and reinforce this basic design, but shortcutting it is an invitation to disaster.

First, assemble approximately 80 feet of twine, non-stretch cotton or hemp, about ⅛ inch thick. The tensile strength should be about 300 lbs.

To construct the stretcher, cut four poles 8 feet long by 2 inches in diameter and ten smaller poles 2 feet long by 1 inch in diameter. Then, step by step:

1. Position the two long poles and two of the shorter poles to form a rectangle. The short branches should be on top and about a foot in from the ends. They should also extend about 2 inches beyond the edge of the long poles.
2. Position the two other long poles beneath the stretcher diagonally so they cross in the center. These cross poles are needed to make the stretcher rigid and stable.
3. Secure the three pieces at each corner with approximately 8 feet of twine as follows: Double the twine and slip it under the branches. Insert the doubled end through the loop formed by the doubling and tighten back on itself. After one wrap, change direction diagonally crossing the first wrap. Divide the running ends and make two or three opposing turns between the branches and around the twine to tighten it (called frapping), and tie off the ends using a square knot. Be sure all wraps are neat and do not overlap each other. If consecutive wraps overlap, they may later slip over each other, creating slack. Lashing must not be done in a hurry; it takes time to do it properly.



4. Space the remaining short branches at equal distances along the length of the stretcher and secure them with short (2-foot) lengths of twine. These ties, too, are important, since they support the victim and are under load continuously during travel. Each branch should be secured by wrapping the twine around in one direction and then the opposite, forming an x. As before, secure the ends with a square knot.

Completed, the branch stretcher weighs about 35 pounds. Six climbers (minimum) can carry it. Again obviously, before loading the injured victim on, try it out with a volunteer.

Pad the stretcher well, using all available insulative pads and extra clothing. Because the top of the stretcher is elevated, the "log roll" cannot be used to get the victim on the stretcher. Instead, use a seven man handlift (three men on each side and one on the head) to raise the victim while an eighth person slides the stretcher under him.

The branch stretcher is intended for trail evacuation only and not for terrain steep enough to require a belay or safety rope. If the terrain is marginal, or if there is any doubt, send for a rigid litter rather than jeopardize the safety or condition of the victim.

Evacuation by helicopter

The helicopter has revolutionized mountain rescue. It has evacuated injured from cliffs and glaciers directly to hospitals quickly and efficiently when by ground it would have taken days of rough and exhausting travel. It has shown itself, time and again, to make the difference between life and death. Consequently, seldom is evacuation of a victim with improvised stretcher over rough terrain justified. Exceptions are:

1. If the weather is such that a helicopter could not respond.
2. If the victim's injuries are incapacitating but not serious; if there is a large party and the distance is short (3-5 miles by trail).
3. If indications are that the victim's condition is deteriorating or would deteriorate (life-threatening) should he not be promptly evacuated.

In most other instances, therefore, the delay in waiting for helicopter transport is advisable for both speed and comfort.

To prepare for helicopter transportation, the party has much to do. First it must choose and prepare a landing site. The first choice should be an area that gives a 360° approach for landings and takeoffs—i.e., a flat-topped ridge that allows both landings and takeoffs to be made into the wind. If a ridge is not close, then a relatively flat area on a hillside is the next choice where a "drop-off" is possible rather than a "climb-up" during takeoffs. The higher the elevation, the less load the helicopter can carry and the more important a drop-off becomes. Choosing a landing site in a valley floor is least desirable.

Next, remove all obstacles that could interfere with the aircraft—brush, trees, stumps, and loose rocks and snow, at least 75 feet in diameter of the landing site. If the landing site must be located in an area of soft snow, pack the site and surrounding area to prevent blowing and obstructing the pilot's vision. Make the area as level as possible (within 10 per cent preferred). Clearly mark the landing area with colored tape or other objects of contrasting color. SECURELY ANCHOR ALL OBJECTS with buried 10-pound rocks if necessary. Rotor wash can apprach 60 to 120 mph.

From the air, even brightly colored objects and arm-waving people are barely visible. Consequently, the best method of signalling the helicopter is by smoke grenade (U.S. Coast Guard-approved, available at most marine supply stores). Smoke not only identifies the accident scene and landing site, but tells the pilot wind speed and direction. If a smoke grenade is not available, a small smoky fire can be built well away from the landing area or rotor wash will scatter it for hundreds of feet. As a preferred alternate, use streamers or plastic ribbon located and securely anchored at the edge and downwind from the landing site slightly to the side of the approach pattern. If none of these is available and a fire inappropriate, a party member can stand with arms extended toward the landing site which indicates "Land here. My back is into the wind."

The party also must prepare the victim for transport and perhaps even transport him a short distance to the landing site. Before the helicopter arrives, the victim is informed of what is going to happen and what he should expect—noise, wind and movement. As stated previously, securely tie the victim into the litter. His hands must be restrained to prevent him from reaching and grabbing. Eye and head protection are a must to prevent injury from blowing debris caused by rotor wash. Secure with the victim any gear going with him that the party does not want to carry out, but do not send items (clothing, ropes, etc.) that may be required by the party later. Ensure there are no loose straps, ropes, or clothing. Tag the victim conspicuously with information concerning his suspected injuries, the first aid treatment given and his condition. Finally, and most importantly, **do not endanger the victim** by hurrying to ready him for evacuation. If it will take more time to secure him to the stretcher, request the pilot wait, or to return at an appropriate time.

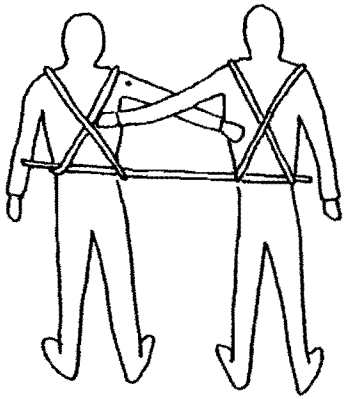
When the helicopter approaches and as the victim is loaded, the following basic Rules of Safety must be followed:

1. If the helicopter lowers a cable with message, radio, or litter, allow it to touch the ground first to dissipate static electricity.
2. If there is a last-minute danger to the helicopter observed by ground personnel, move your arms from the side horizontally to overhead several times indicating "Do Not Land."
3. Keep well away from expected approach and takeoff patterns of the aircraft.

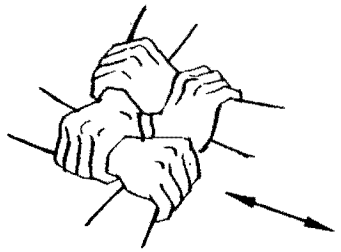
(36)

4. Stay at least 75 feet away from the landing site until the helicopter engine is off and rotor has stopped, or until the pilot signals you to approach. Even after touchdown, the pilot may want to shift the helicopter's position.
5. Always approach or leave the helicopter from the front so the pilot can see you at all times.
6. Never approach or leave the helicopter from any side where the ground is higher than where the helicopter has landed.
7. Keep your head down since the slower the rotor is moving, the lower it will dip (sometimes down to 5 feet).
8. All personnel and especially the victim, should wear hard hats and have eye protection.
9. The victim should not be placed unattended in the helicopter unless he is restrained.

SEE ALSO PAGE 40.



TWO MAN SLING AND POLE CARRY



a. The four-hand seat carry is an excellent method for carrying conscious, not too seriously injured persons a short distance.

Seat carry.

b. This is an effective method of carrying an unconscious injured person a short distance provided it is not necessary to keep him flat.

The Outing

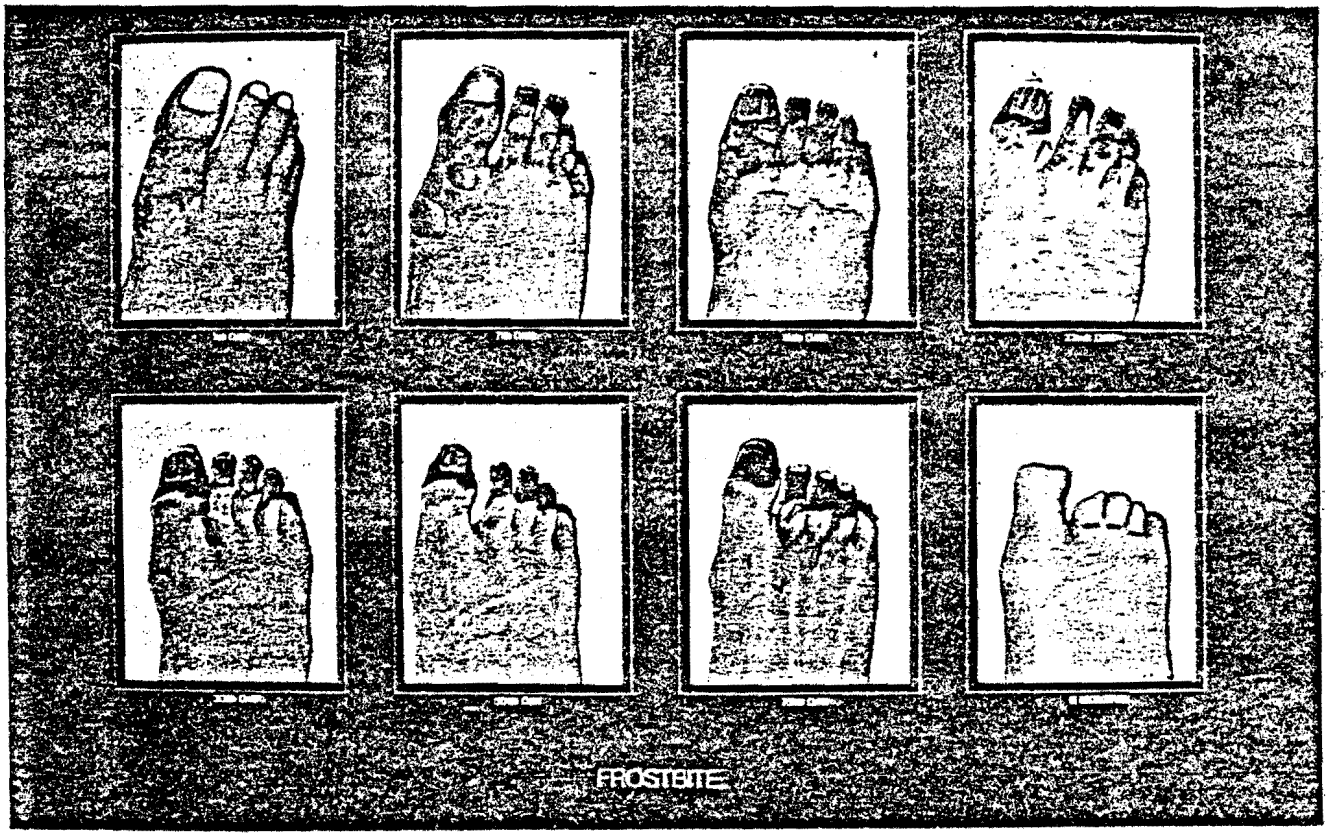
by Ted Morgan

A cautionary tale, both true and miserable

In his room at Willamette Falls Hospital, Scott McIntire finished five colored-pencil drawings of his toes. His feet posed compliantly under the sterile sheet held up by an aluminum tent. On the first day, his toes were pink. On the seventh, they were turning purple. On the twenty-eighth, they were blistered and blackening. On the thirty-fifth, they were almost totally black, and on the forty-fifth day, they looked as if they were covered with tiny black hoods. Soon after, parts of all ten toes were amputated.

The paintings were emblems of loss, not only the loss of his toes, or the loss of his wife, but a loss of innocence, an awareness gained at great cost that a man who has done nothing to deserve it can be struck down, that there is no such thing as safety, and that what we most cherish can turn against us. The paintings were also an example of Scott McIntire's quality of detachment. He calmly painted the toes he was about to lose, as if they belonged to someone else. When he was trapped in the snowstorm with his wife and infant daughter, and felt in his bones that they were doomed, the weather cleared momentarily and he found himself admiring the view, the fir forest, the glittering snow, the mountains in the distance, forgetting his predicament.

Until he reached the age of twenty-eight, Scott McIntire's life advanced on an easy, pleasant, downhill grade. He was born in Salem, a town fifty miles south of Portland, Oregon, the son of a printer, and went to school there. He learned as a boy that an Oregonian's birthright is knowing how to survive in the wilderness. He grew up hearing epic tales of the settlers who had come over the Oregon Trail in the 1840's and conquered nature once and for all—of men like Finan McDonald, who fought and killed a wounded buffalo with his bare hands, and many others who survived



Indian attacks and murderous winters and poison alkaline water pools on the long trek from Missouri.

The teen-age life-style in western Oregon percolates from California, losing some of its strength but not its flavor. Scott had an *American Graffiti* adolescence, with drag races on the outskirts of town, a drive-in that served as a motorized paseo, and sock hops in the gym so jitterbugging feet would not mark the basketball court. His first commissions as a painter were pinstriping his friends' jalopies. He dreamed of California, where the action was.

He went to Los Angeles in 1963, the one and only time he ever left his home state, and studied advertising design at the Art Center College of Design. He didn't like the hustle of advertising, and his parents might have had to mortgage their home to keep up his tuition, so he stayed only one of the four years. Coming home did not seem like a defeat. It was, rather, part of an ordained chain of events. Scott could now lead the predictable life for which he was intended, working in the art department of the local newspaper, and marrying Sue, a girl to whom all the cheerleader adjectives like cute and pert applied.

In 1967, however, Scott moved to Portland and enrolled in Portland State University. A reminder of his stay there still stands, an abstract mural on one wall of a small power-plant building, its colors fading. In the National Guard, where he served for six months, Scott learned such basic survival techniques as this: if two people are caught in a snowstorm, they can keep their feet warm by placing them in each other's armpits.

At Portland State, Scott formed a friendship with a co-ed, a former airline stewardess named Diane. She was permanently cheerful, like a climate with no seasons, and she looked good in angora sweaters. Like Scott, Diane was married and was working toward a degree in painting. It wasn't that Scott and Diane were unhappily married. They were indifferently married. When they were together, they plunged into the realm of romantic clichés that sound embarrassingly maudlin to everyone but the participants. "There was a greater clarity and meaning to our lives," Scott said.

In 1970, Scott and Diane graduated. Scott's wife Sue had taken an office job to help pay his tuition. Diane left for Minneapolis, where her husband would be getting his doctorate. Scott threw himself into his work. Overcoming his distaste of advertising, he became art director of a Portland agency, Branch & Bauer. At home, he worked on photo-realist paintings. Choosing a banal subject, like a diner or a milk shake in a paper cup, he photographed it in color and projected the slide on a canvas, painting over it with a spray gun and brush to get the precise shading and delineation. He was apologetic about the $600 he charged for a painting, explaining: "It takes me a hundred and fifty hours to do one. That's only four dollars an hour."

From Minneapolis, Diane wrote long melancholy letters—she missed Oregon, its lush green meadows, its snowcapped mountains, its wild coast. She came back for a visit in 1971, and she and Scott decided to get divorces. It was a cruel surprise for Scott's wife and Diane's husband, who at first opposed the divorces. At least there were no children involved.

Scott and Diane lived together for a year, and were married in May, 1972, outdoors, in the McClay Bird Sanctuary, a thirty-five-acre park on a forested hill above downtown Portland. They often went there with binoculars and a camera. "Neither of us was religious," Scott said. "Nature was the closest thing we had." Frank Case, a bear of a man whose wife was a childhood friend of Diane's, was at the wedding. He took photographs, but the camera was badly loaded, and none of them came out. Mr. and Mrs. Gordon Strom, Diane's parents, also attended the ceremony. Scott, twenty-seven, with his wavy reddish-brown hair and gentle blue eyes, looked like a defrocked Franciscan friar. Diane, twenty-nine, with her long blond hair, resolute expression, and beauty-queen shape, was like a prow figure.

They had the kind of marriage that would make Erich Segal blush. The barometer was always set at fair. They shared their love of art and outdoor life. Most weekends found them in one of the many scenic areas near Portland, such as Mount Hood, or the Columbia River gorges. They shared housework and cooking. Mike Carmel, a close friend, said: "I have never seen another couple like them. They had broken through the male-female role-playing. They radiated happiness. It made me almost envious."

When Diane became pregnant, Scott attended natural-childbirth classes at Kaiser Hospital, which were designed for couples so that the father could be present at the birth. He was shown films to help him understand the difficulty of labor. In class, Scott was told that after twenty hours of labor, birth would be induced. But Diane was in labor for twenty-eight hours, with Scott at her side. He took snapshots of his daughter, still covered with the reddish film of the placenta, when she was born at 8:41 a.m. on June 15, 1973. She was named Emily Strom McIntire. Scott sold Mike Carmel a painting of a Hollywood Hamburger stand to help cover the maternity expenses.

The first weekend in November, when Emily was four and a half months old, Scott had a layout to prepare for the agency by Monday. He was planning to work that Saturday, November 3, but when he heard on the morning news that Sunday would be stormy, and when he looked out the window and saw that it was a fine, clear day, he and Diane decided to go out. In Portland, where it rains two days out of three, it's hard to resist a sunny day.

They thought of a place where neither had been, Bagby Hot Springs, about fifty miles southeast of Portland. The water bubbles out of the rock at 137 degrees Fahrenheit, and a wooden trough feeds it into cedar bath stalls with tubs hollowed from big logs. They planned to be back by nightfall.

Scott thought it might get cold and wore a new wool Pendleton shirt and a hooded windbreaker. He made Diane put on a raincoat over her wool pants and sweater and leather jacket. They both had wool caps, gloves, and waffle-stompers. Blond, blue-eyed Emily was bundled into the fur-lined pink snowsuit Diane had just bought at Sears. They took a camera, a blanket, a diaper bag, two pastrami sandwiches, an apple, and a thermos of hot chocolate. Emily's diet was no problem, Diane was nursing her.

"This was a common thing for us to do," Scott recalled. "To drive up and have a picnic and look around at what nature has to offer. Oregon is a nature lover's paradise, there's so much plant life and birdlife. There are so many places within a few hours' drive that offer splendid scenery."

Scott, Diane, and Emily left Portland at 12:30 p.m. in their blue 1966 Chevrolet station wagon. Scott was sliding behind the wheel when he realized he did not have a map of the Bagby area, which lies in the foothills of the Cascade mountain range. He went back into the house but could not find the right Forest Service map. In the car again, Diane *(Continued on page 185)*

(Continued from page 165) pointed out that they did not know the way to Bagby. Scott got out and called a friend who did know, Martha Forster. He scrawled the directions in pencil in their address book, which he left next to the telephone—Estacada turnoff—ranger station—Timothy Lake—Bagby.

At the town of Estacada, thirty miles from Portland, they took the road to the Ripplebrook Ranger Station, where Scott stopped to take some free pamphlets from a box. From the ranger station to Bagby it was another thirteen miles. About five miles from the hot springs the road was closed off, probably because of a mud slide, and a cardboard sign indicated a detour on a graveled service road.

Reaching Bagby, Scott parked the station wagon, and they hiked a mile and a half uphill to the springs. Scott saw mushrooms by the side of the road and tried to pick them, but they were frozen hard. The five bathing cabins were occupied. Scott and Diane ate their sandwiches and drank their hot chocolate while they waited. A couple came out of a cabin and they exchanged greetings with them and went in. Scott pulled a mossy wood plug and the water poured into the log tub, too hot to bathe in. Scott took a bucket and filled it in a stream twenty yards away, adding cold water to the tub. Diane took off her clothes and got in. The light filtering through the cabin's green fiber-glass roof gave her skin a greenish glow. Scott thought how nice it was to see her getting her figure back and what a lovely sight she was in the water.

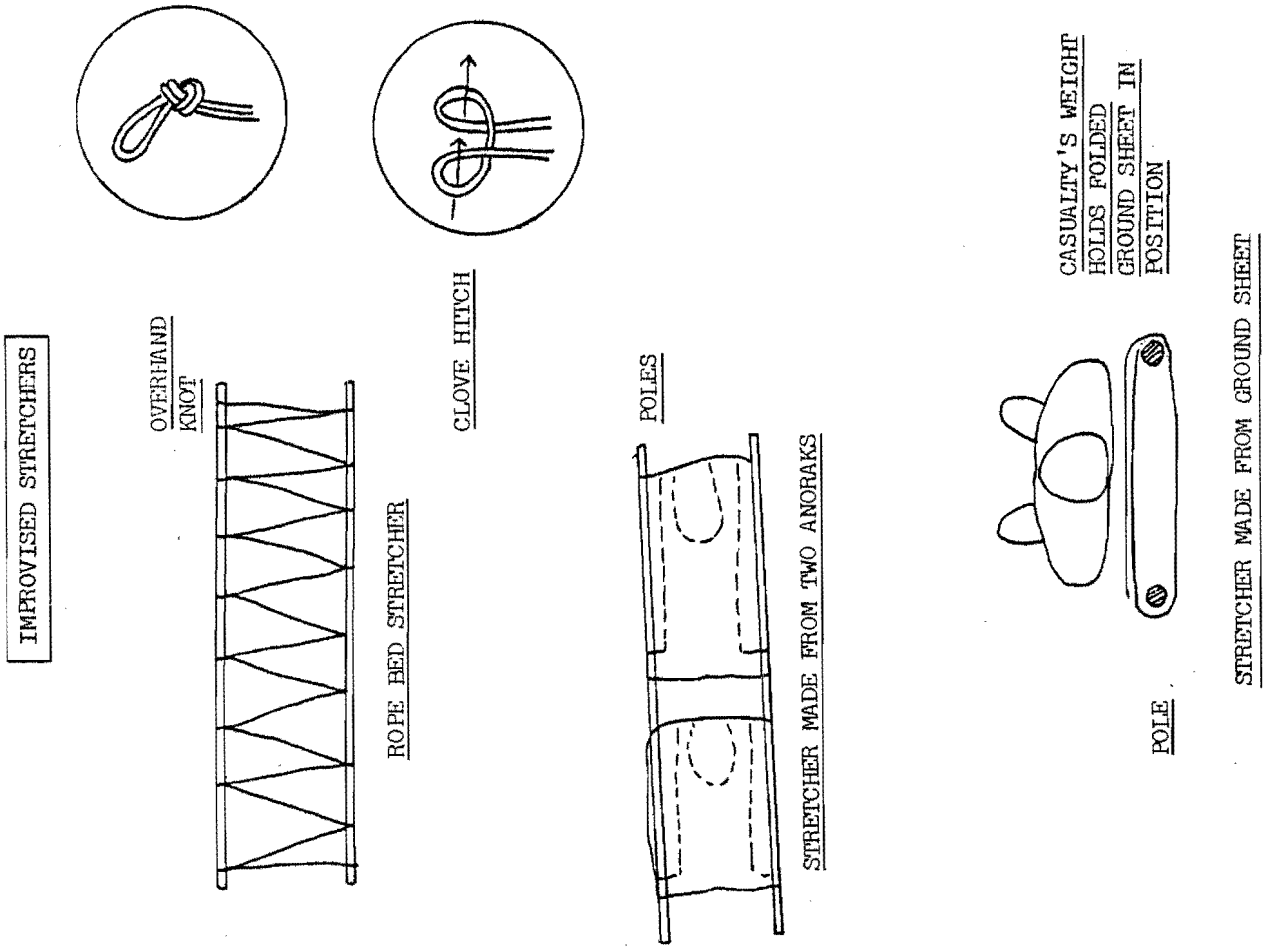
Scott rubbed Diane with a towel and took his bath while Diane held Emily. Looking out a window from the tub onto the slope of the hill, with the forest in the background, Scott noticed that it had started snowing. There was no wind, and the large, soft flakes fell in unhurried silence. It seemed to him a comforting sight, like a Currier and Ives print of winter.

On that same Saturday, Charles Mock, a twenty-three-year-old part-time U.S. Forest Service employee, seeing that it was a nice day and that the weather forecast made no mention of snow, decided to go hunting elk and deer in an area he knew well, around Wahtum Lake on the northern slope of Mount Hood, about forty miles east of Portland and forty-five miles north of Bagby in the Cascade Range. He planned to be gone from Portland several days and took some dried food, a sleeping bag, an aluminized space blanket, a tarp, an ax, a water bottle, a knife, matches, and his thirty-aught-six rifle. He parked his new Toyota pickup truck at the edge of the lake and set out onto the forested slope, looking for elk and bear tracks. He was surprised when it started snowing in the afternoon, and he made camp.

By the time the McIntires were back at the parking lot, there was a foot of snow on the ground. Scott wondered at how quickly it had built up. "Let's get going," he told Diane. "I want to get past that detour before it gets dark." Scott followed the tracks of two teenage boys in a Volkswagen, who had left a few minutes ahead of him. The sign marking the detour was by this time covered with snow. Instead of the detour road that would have taken them to the Ripplebrook Ranger Station eight miles away, the VW, followed by Scott's station wagon, took a logging road that twisted through the forest for twenty miles until it reached a main road.

The station wagon started skidding in the snow. Diane drove, and Scott spread the blanket under the rear wheels to give the car enough traction to gather momentum. It moved uphill by fits and starts over the narrow snow-covered road with a sheer drop on the right. Scott placed the blanket, ran to catch up, watched the station wagon skid dangerously close to the edge, then placed the blanket again.

One of the rear tires was nearly smooth, and Scott remembered that he had a new radial spare. He jacked up the car in the failing light, and changed the tire. When he eased the car down, he saw that the spare tire was flat. He had to put the old tire back on. It was Scott's first moment of discouragement. He was already tired from running behind the car and now he



thought: all that effort for nothing.

They resumed the laborious process with the blanket. By this time it was dark. Scott, watching from behind, saw the station wagon's taillights veer to the left. The car had skidded into a ditch. They realized they would have to spend the night there. The gas gauge read a quarter full. Scott turned the heater on, and they spent most of the night drying their clothes. They would keep the heater on for twenty minutes, sleep until the cold woke them, and turn the heater on again. They finished the hot chocolate and divided the apple. Every three hours, Diane nursed Emily for twenty minutes. The blanket Scott had used under the wheels was encrusted with frozen snow, and he made no effort to dry it.

Awakening on Sunday morning, they saw that the car was buried under snow. Sunday was Diane's birthday. She was thirty-one years old. They remarked, half laughing and half worried, that it was a hell of a way to spend a birthday. They discussed whether they should wait in the car to be rescued or hike out into the by now knee-high snow. Scott was convinced they could not be more than five miles from the ranger station. "We can make it with very little trouble," he told Diane. She agreed, and it was eight a.m. by the car clock when they started out. Diane nursed Emily before leaving the car. Scott had found an umbrella and a plastic garbage-can liner in the back of the station wagon. He pushed through the snow, with Emily on his back, and the upright umbrella handle wedged between them. Diane followed in single file, carrying the diaper bag and the camera. They never considered separating, Scott hiking to the ranger station while Diane and Emily stayed in the car. They always did everything together.

We have dreams of self-sufficiency. The myth has been drummed into us for centuries that there is nothing American ingenuity can't lick. Here is a settler arriving in virgin territory in 1832, fifty miles from Portland: "I caught from the prairie a span of horses with a lasso, made a harness, and set them to work. The harness I made from deerskins, sewed in proper form, and crooked oak limbs tied top and bottom with elkskin strings. Then to these, strips of hide were fastened for tugs, which I tied to the drag made from the crotch of a tree. On this I drew out logs for my cabin, which, when I had laid up, I put up rafters. To make the roof I covered it with bark peeled off from the cedar trees. This bark covering was secured by poles crossed and tied at the ends with wood strings to the timbers below. Then out of some split planks I made a bedstead and a table, and so I dwelt in a house of fir and cedar."

Scott, like his nineteenth-century forebear, could have made good use of the materials at hand. He could have cut blocks of snow for a shelter with his license plate. He could have punctured the gas tank and drained the oil for fuel. His matches were wet, but he could have soaked a rag in gasoline, and touched an insulated wire to a battery terminal to light it from the spark. He could have set fire to a tire, which burns for hours with billows of oily black smoke, and melted snow in a hubcap.

Scott and Diane could not walk more than fifty feet through the snow without stopping to rest. At each turn of the winding road, they thought they would reach the top of the ridge and come within sight of the ranger station, but instead they saw another turn. At about ten a.m., after two hours of walking, they stopped beside a small waterfall and Diane nursed Emily. She opened her coat, lifted her sweater, unsnapped her bra, and Emily's head disappeared under the tan wool sweater. Diane ate snow. She felt it was the only way to keep up her production of milk.

Body heat, produced from food intake and muscular activity, has a narrow temperature range. Between 97 and 98.6 degrees Fahrenheit is normal. Above that you are feverish, below that you are losing body heat. When the balance between heat production and heat loss is broken, and body temperature drops below 95 degrees, a condition called hypothermia sets in. The body's inner core cools to a level at which normal metabolism breaks down, which leads to a numbing of the body and brain, and can eventually cause heartbeat and respiration to fail. One sure way to lose body heat is to eat snow. It takes as much heat to turn one ounce of snow to water as it does to heat an ounce of soup at room temperature to boiling.

Scott and Diane walked two hours more, then stopped beside a tree, where Diane nursed Emily. Diane ate more snow, melting it in her mouth. She wanted to turn back. Scott was bent on reaching the ranger station. They had already gone three miles, they only had two more to go. Turning back was counterproductive, he told Diane. They were moving closer to rescue.

The snow was so deep that they could only advance ten feet at a time before stopping to rest. "You would look ahead and know that normally it would take five minutes to reach the turn, and you would reach it forty-five minutes later," Scott recalled. He kept looking for an area he had spotted driving in on the detour, which had been cleared and set aside for people to collect firewood.

At about three that afternoon, they came to a fork in the road. Snow was falling heavily and visibility was poor. Scott chose the downhill branch, but after 500 feet they were blocked by a snowbank. There was no way around it. "We must have taken the wrong road," Scott told Diane. Like the flat spare tire, it was useless effort. They went back to the fork, Diane following Scott. Scott turned around and saw Diane walking listlessly, her bare hands dragging and making light furrows in the snow. "Where are your gloves?" Scott asked. "I don't know," Diane replied. She had also dropped the camera and the diaper bag.

Diane waited at the fork as Scott explored the second road. It stopped suddenly at the slope of a hill. A strong wind had risen, dark with falling snow, which whirled through the fir branches and whipped his face. His legs ached from pushing against the drifts. There was nothing to do but turn back. They had planned to hike into the night, but they were too tired. It was getting dark, and they had to find some sort of shelter. Off the road, Scott spotted a cut log lying across a dip in the slope. "Let's spend the night here," he told Diane. He shoveled the snow out from under the log and they both lay down under it with Emily between them, on a diagonal. They were covered above the knees, and put their legs in the garbage-can liner. Scott told Diane that if the log had covered them completely, they could have kept their feet warm in each other's armpits.

They took turns holding Emily. Diane nursed her. Scott collected snow from his side of the log and fed it to Diane. For the first time, they discussed the

possibility that they might not survive. Scott was still optimistic. Martha Forster knew where they were. There was probably a search party out for them already. The VW in front of them must have told the rangers there was another car coming. But the VW in front of them, being on the wrong road, did not pass the ranger station; although it was a lighter car with better tires, it also bogged down farther along. The boys made their way to a log truck, where they waited for rescue.

Back in Portland, Diane's sister Susan, twenty-seven, a tall, flaxen-haired, restless young woman who wants to be a doctor, was driving home from a party on Saturday night over icy streets. Crossing a bridge over the Willamette River she skidded and crashed into a column, breaking her nose. A friend, following in another car, took her to the emergency room of a nearby hospital, where she remained until four on Sunday morning. "Normally I would have come around on Sunday for Diane's birthday," Susan said, "but my car had been totaled, and I was on Demerol. I called and there was no one there, but I didn't think anything of it. They were often off on weekends, and I figured they were staying in a lodge." Susan knew Scott and Diane had gone to Bagby. She was staying with Martha Forster, the friend who had given Scott directions.

In Lincoln City, on the Oregon coast, ninety miles away from Portland, Diane's mother, Mrs. Gordon Strom, mailed her daughter a swirl skirt for her birthday on Friday. Mrs. Strom, a practical woman who runs her own fabric shop, was promised by the post office that Diane would have the gift on Saturday. She wanted to call on Saturday and ask whether the post office kept its promises, but she didn't, because "I don't like to seem nosy about what the children are doing." She did, however, call on Sunday morning. There was no answer.

A little later, Susan called her mother and said: "I hate to tell you this, but I broke my nose and wrecked my car last night."

"Do you know where Scott and Diane are?" Mrs. Strom asked. "I can't reach them."

"They're on an outing," Susan said. "They must be in a lodge."

Mrs. Strom kept trying to reach them until eleven Sunday night.

When Charles Mock, the Forest Service employee who had gone hunting on Mount Hood, woke up on Sunday morning, his tarp was sagging under the weight of snow. He broke camp, and it took him six hours to hike the four miles back to his Toyota pickup in the waist-deep snow. He turned on the truck heater and dried his clothes—he was dressed entirely in wool, from long wool underwear to wool Army pants and a wool shirt and wool mittens and wool socks and a wool-lined denim jacket. He spent the rest of the day building a shelter, packing the snow down, setting up his tarp, and gathering firewood. "I got myself squared away," he said.

Monday morning found Scott and Diane huddled together under the log, trying to keep warm. Scott had gotten up to urinate during the night, leaving his gloves where he was lying. When he returned, he couldn't find them. It wasn't much of a loss, he thought, they were leather and soaked through. He and Diane kept their hands in their armpits. They were by now so weakened mentally and physically that they could not move at all. They sat under the log and looked out at the white November sky and the snow that continued to drop, more lightly now. They wanted very badly to believe that the ranger station was within earshot, and they yelled for help. Diane, although she was not religious, prayed. Scott tried E.S.P. He concentrated very hard on making contact with the rangers. Emily, like an alarm clock, regulated their sleeping. She would start crying, and they would wake and Diane would nurse her. "I can't feed her as much," Diane said, and ate more snow. The snow gave her pains like labor pains. They were shivering constantly now. Scott told Diane it was good to shiver. He remembered from his National Guard training that it kept your muscles moving and helped retain body heat. Trying to keep Diane's spirits up, Scott said: "It's Monday. People know we're lost. They're getting together and looking for us."

On Monday morning, Scott had a nine a.m. appointment with a printer to choose the color for a client's letterhead. When he didn't show up, the printer called the Branch & Bauer agency. Scott didn't miss appointments, and his boss, Tiger Branch, started worrying. At 9:30 a.m. Mrs. Strom called Diane from Lincoln City, and when there was no answer, she called the agency. The secretary said: "Scott's not here, but he always calls when he's not coming in." Mrs. Strom then called Susan and said: "I'm concerned. I can't reach Scott or Diane. Something's wrong."

"I just remembered," Susan said, "they went to Bagby. I bet they got stuck up there. I'll call the forest rangers."

Susan called the Estacada Forest Service at 9:30 a.m. She was told a Sno-Cat was on its way to Bagby, as several persons were missing. "We'll call you back when we get a report," the Forest Service said. "I stopped worrying," Susan said. "I thought they must be in their car in the parking lot." At the same time, Tiger Branch tried to hire a private helicopter, but could not find one that would fly in the snow.

At three p.m., the Forest Service called Susan and told her that the Sno-Cat had reached the Bagby parking lot but that Scott's station wagon was not there. They advised her to call the Clackamas County Sheriff's Office, which is responsible for the Bagby Springs area, and report them missing. Susan talked to Sergeant Lloyd L. Ryan, a big affable man who puts his heart into search-and-rescue missions because he spends so much of his own spare time in the wilderness. Ryan took down the facts and said, "Okay, I'll call you when I've checked."

Ryan organized a search party, using the Ripplebrook Ranger Station as his base. He called Susan back at five p.m. and told her they were going out that night. "We had four big Sno-Cats and ten snowmobiles out looking for them that night," Ryan recalled. "They were finally called off, they couldn't do anything in that snow." Ryan also contacted the state aviation officer of the Army National Guard in Salem, Lt. Col. Gale Goyins, who agreed to keep a Huey helicopter on standby, ready to fly as soon as the ceiling lifted.

Charles Mock, warmed by the fire he kept going and nourished by powdered eggs, kept busy on Monday. He cleaned the snow from the hood of his Toyota pickup so it could be spotted from the air, and laid his space blanket out for the same reason. He cut big piles of firewood. He started the pickup only once, to listen to the news. He heard that quite a few persons had been caught in the unseasonal snowstorm and that search parties were out. He felt foolish—a Forest Service employee lost in his own district.

He thought of getting out. He knew he was about thirteen miles from the nearest town and decided he could make it on snowshoes. He knew how the webbing went, he had seen it in backpack magazines. He cut four noble-fir saplings, six feet long, tested the tough, springy wood, and squared them up with his ax. Tiring, he remembered a bush of blue elderberries he had noticed near the truck. He was surprised to see elderberries at 4000 feet, stepped off the road, up to his neck in powder snow, and picked as many berries as he could. That night he boiled them into a mush with half his sugar. He had never tasted anything better.

As the Monday hours slipped by without any sign of rescue, and with their strength ebbing, Scott and Diane took a hard look at their chances. They searched for an explanation. Was God punishing them? Were they part of some destiny they could not grasp? They refused to accept the idea that they were somehow at fault, or victims of a grand design. Scott said: "We were in the wrong place at the wrong time, that's all."

"This is a crazy way for it to end," Diane said. Everything had been going so well. They had finally had a baby, they had finally bought a house. They were remodeling it, they had been so lucky, they were so happy. "We got more out of the two years we spent together than most people do in a lifetime," Scott said. Diane's body heaved with dry sobs. She was physically unable to cry.

Diane said: "It's just not fair."

Diane said: "I wish we had made love one last time in the car when we had the chance, because we never will again."

Diane said: "You'll live longer than I will."

Diane said: "If we die Emily will die. What a terrible thing to bring her into the world and have her die four months later. What a terrible thing to do."

"That's why we have to hold out," Scott said. Scott kept going over the steps in the rescue. By now, they are at the ranger station with Sno-Cats, he said, and they will have started up the detour road and found the car. It can only be a matter of hours. It was time to nurse Emily, and Scott scooped up some snow and handed it to Diane.

As night fell, Scott was alarmed by Diane's behavior. She no longer seemed to care about keeping herself warm. Her hands contracted into claws, and she could no longer hold Emily. She became delirious, and snatched at Emily and Scott with her stiff, bent fingers. Scott felt he had to protect Emily from her mother. When he tried to talk to Diane, she replied incoherently. He could not get her to say her name, or recognize Emily.

Scott awoke during the night to see Diane lying with her eyes open. He felt her pulse. There was none. He put a finger under her nostrils. There was no breath. He tried to close her eyes. They stayed open. Scott felt no remorse, only an overpowering sense of helplessness. He tried to remove Diane's raincoat to use as a tarp over the log, but he was too weak. He thought: "I've got to hold on. I've got to feed Emily."

Emily no longer squirmed or fussed, she only whimpered from time to time, enough to awaken Scott. He melted snow in his mouth and fed her the water mouth-to-mouth. By now, every time he ate snow, he threw up. He still believed he would be rescued. His feet felt like clubs. He tried not to think about Diane. Instead, he fantasized about having his feet amputated. He could continue working as a painter, but he would have to get around in a wheelchair. He would have to build ramps and rails all over the house.

There was no one to blame in Diane's death. She was the victim of circumstance. She was also a casualty, perhaps, of the "return to nature" trend. We read the *Whole Earth Catalog*, we hear about communes living off the land, we watch the Apple family on the tube finding a meaningful life in a return to native Iowan soil, and we think we are regaining our lost innocence. We think we can escape doomsday by concerning ourselves with ecology and the preservation of natural beauty. We promote the sentimental view of a benevolent nature which can solve our problems and make us better men. We yearn for Walden Pond, and forget that one can drown in Walden Pond.

On Tuesday morning, Mr. and Mrs. Strom arrived at Scott's house in Portland. A reporter interviewed Mrs. Strom, who said: "I'm not worried, they have their sleeping bags and they're both good cooks."

Sergeant Ryan called Susan on Tuesday morning and said "no luck."

"Have you talked to any other people who were picked up at Bagby?" Susan asked.

"Don't worry," Sergeant Ryan said. "We're checking all the angles. By the way, did they have sleeping bags?"

"No, they didn't," Susan said. "Their sleeping bags are in the attic."

"Oh, shit," Sergeant Ryan said.

On Tuesday morning, the Sno-Cats were out again. Volunteers, including two Boy Scout troops, came to the Ripplebrook Ranger Station and joined in the search. There were about a hundred persons involved. It was Oregon's biggest rescue operation in years. But they could do nothing. The snow was impenetrable.

On Tuesday morning, Charles Mock ate the rest of his berries and some biscuits. He noticed that it had almost stopped snowing. He worked all day on his snowshoes, cutting grooves in the tips of the squared saplings and lashing the ends together with the rope he had planned to use to lash his kill across his hood. He tied slats across the looped saplings, then cut strips from the rubber floor mat of his Toyota for the webbing. When it was dark, he worked by the light of a battery lantern.

Frank Case, who had been at Scott and Diane's wedding in the bird sanctuary, came home from work on Tuesday evening, turned on the news, and heard that his friends were missing. He called the sheriff's office and asked: "Is there anybody up at the ranger station representing the family?" "We don't want the family," he was told, "they're too emotional." "I'm coming up," he said. "I'll stay out of the way." At the ranger station, Frank acted as liaison with relatives and friends, discouraging them from joining the search. It was a frantic scene at Ripplebrook, with volunteers who had to be fed, campers asking for permits to burn firewood, and hunters coming in with deer.

By Tuesday night, the search party had made no headway at all. The rangers were pessimistic. There's not much chance they're still alive, they said, they've been out there since Saturday. We're going to have to make this a daylight operation. Sergeant Ryan insisted: "We've got to keep this thing going." The Sno-Cats were out again that night.

On Wednesday morning, November 7, a front-page headline in the *Oregon Journal* read:

TRIO BELIEVED SAFE IN SNOW
Baby Complicates Survival

The story was based on an interview with Diane's mother, who was quoted as saying: "I just feel they are holed up somewhere. They might try to get out, but because of the baby, I doubt it. . . . Scott is a very cool-headed person. I have faith in his judgment, especially in a situation like this."

Scott looked out that morning from under the log where he had been for three days and saw snow falling from the branches of trees. That meant it was getting warmer. The sky was clearer. His hopes lifted.

It was still foggy, however, and when Sergeant Ryan checked the National Guard early that morning, he was told: we just can't fly.

Around noon, two helicopter pilots stopped by the ranger station to borrow a Forest Service radio. They worked for a private company, Willamette Helicopter Service, and were on their way home for the winter; they had been up the valley dropping chokers (self-tightening cables for lifting logs) for other loggers to use in clearing timber by helicopter later.

Frank Case went up to the chopper pilots and said: "Will you fellows fly search and rescue?"

"Sure," they said. "Who's paying for it?"

Case called Tiger Branch, who said he would cover the cost. The chopper pilots gave him a special price of $125 an hour. They were off the ground at 1:10 p.m. Case called the Stroms and said: "Don't get turned on, but we've got a chopper out there."

In the meantime, Sergeant Ryan called the National Guard to tell them they finally had flying weather and the National Guard sent the Huey to Ripplebrook. The Huey took aboard Sergeant Ryan and two press photographers and flew off in the Timothy Lake area. Scott had mentioned Timothy Lake in the directions to Bagby penciled in his address book.

Soon the small helicopter radioed the Huey: "We've spotted a rectangular lump in the snow on Forest Service road S seven oh nine that looks like a car," and gave the map coordinates. The small helicopter was almost out of gas and went down to refuel. The Huey found the spot and hovered over the lump, close enough to recognize the shape and verify that it was a car.

"I saw the contours of what appeared to be a station wagon," Sergeant Ryan said. "Leading away from the car there was a faint indentation in the snow that could have been a trail. It was solid, not interrupted like an animal trail."

They followed the trail and came upon a log with an arm waving from under it. The log was on a slope, with a utility line in the way. Unable to find a place to land, the pilot, Major William Gottlieb, found a clear-cutting about sixty yards away, where he hovered close to the ground.

Scott heard the helicopter and came out. Several men were running toward him. One had a camera and took his picture. My God, reporters, Scott thought, there's always one around. Sergeant Ryan asked him what his name was.

"Scott McIntire," he said. "My wife has been dead for two days. The baby is alive."

"We've been looking for you," Sergeant Ryan said. "You're all right now."

"I picked up Emily," Sergeant Ryan recalled, "and she took one look at me in that flying helmet and started crying."

Scott said his feet were frozen and he couldn't walk. Sergeant Ryan and a photographer supported him to the helicopter. They wrapped him in a blanket and went back for Diane.

When the helicopter took off, Sergeant Ryan saw a set of Sno-Cat tracks that had gone to within half a mile of Scott's car. It took the helicopter twenty-seven minutes to reach Willamette Falls Community Hospital. "The red line on a Huey is at a hundred and twenty knots and that's where Gottlieb put it and that's where he kept it all the way to the hospital," Sergeant Ryan said.

A strange thing happened in the helicopter. Sergeant Ryan, whose working day is made up of violence and death, wept. "It got to me," he explained. "I'd been working on the rescue since Monday, and I wanted her to be alive so bad. It seemed like such a hell of a waste, to lose your life for an afternoon jaunt."

Scott was taken to the emergency room at 3:40 p.m. His rectal temperature was 94 degrees. His four extremities were thawed in pans of hot water, and he was treated for severe frostbite. Diane was buried several days later. Emily was in fine shape. All she had was a diaper rash. Had she been old enough to thaw out her own snow, doctors said, she probably would not have survived. Women, because they have a thicker padding of subcutaneous fat, normally withstand severe cold better than men. Diane had died, Scott was informed, because she had eaten snow to nurse her baby.

On Wednesday morning, Charles Mock took five more hours to finish his second snowshoe. He cooked the rest of his food, ham and navy beans with a cheese sauce, and made tea with the rest of his sugar. When he started out, he soon found that the floor mat rubber bindings weren't strong enough. He replaced them with the leather strap from his binoculars and canvas strips cut from his backpack. He was able to do about a mile an hour. The snow by now was heavy and wet. It rolled over the tops of the snowshoes and had to be shaken off every hundred yards. Walking was such hard work that he stripped down to his shirt in the freezing cold.

By dark, he had reached the first road junction. The storm had driven the deer from the high ground, and they had packed the snow in making their trail on the road he was on. He tried walking without snowshoes in the narrow deer track, and it was only ankle deep. He walked five more miles until he reached the west fork of Mount Hood, at the forest boundary. Another mile brought him to the first house in the village of Dee Flat at one a.m. on Thursday. It had taken him thirteen hours to go thirteen miles. He called the Hood River Sheriff's Office and was taken home.

Mock's main worry was that his new pickup truck would be damaged by the snow if it was left all winter on Mount Hood. Once the weather had changed and much of the snow had melted, he went back up the road and suddenly saw his truck coming toward him. Three teen-agers had broken into it, put chains on the tires, and driven it through the thin snowpack. ##

HYPOTHERMIA:

A SUMMARY FOR

MOUNTAIN RESCUE PERSONNEL

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NOTE: This paper assumes that readers have a solid grounding in general emergency care, and thus basic emergency care measures are mentioned only in passing. All recommendations contained herein may be found in the medical literature, but actual patient care procedures must be determined by a group's physician medical advisor or by local protocols.

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HYPOTHERMIA

A Summary for Mountain Rescue Personnel

INTRODUCTION

Hypothermia is a familiar adversary for most who work or play in the wilds, and especially for mountain rescue group members. Acknowledgement of the environmental hazards leading to exposure and hypothermia, prevention of exposure by proper clothing and behavior, recognition of incipient exhaustion or hypothermia (they are often indistinguishable), and first aid treatment for borderline hypothermia (candy, warm fluids, shelter and rest) are essential parts of any competent outdoorsperson's preparation for the wilderness. As mountain rescue team members, we have an additional duty to keep the subtle hazard of hypothermia in the public's eye, and to conscientiously educate others in the ways of dealing with hypothermia weather.

The point of this article, however, is to deal with hypothermia as a medical problem in the context of our caring for our patients. Trauma - such as with the victim of a fall, or dehydration and exhaustion - such as with a lost child found after three days search, or medical problems - such as a diabetic or epileptic placed in a suddenly stressful situation during a climb - any of these, even on a summer day, should cause the thought of hypothermia to leap to the forefront of the rescuer's mind. Hypothermia is not an occasional winter problem, but a probable complication for any wilderness rescue.

THE PROBLEM

If we wish to put our field treatment of hypothermia on a sound medical footing, we must go to the medical literature and see what the medical community has to say. However, the footing we find is shaky at best: some authorities say slow rewarming (i.e. blankets and a warm room) is the best treatment and results in above a 50% save rate[1]; you can find an equally reliable report that such passive rewarming results in 0% survival, but that fast, aggressive rewarming will result in a 50% save rate[2]! There is a story about three blind men of Cathay who were introduced to an elephant for the first time; it goes like this: The first blind man put his hand on the elephant's tail, and remarked: "Gentlemen! This elephant creature is very like a rope," to which the second, feeling the elephant's leg, replied: "Nay, you are much mistaken, for it is very like a stout tree," and of course the third blind man, feeling the poor creature's trunk said: "Are you guys out of your minds? It's obviously some kind of snake!"* The point is, of course, that natural phenomena may present disparate, almost contradictory faces to us when we lack the perspective or sense to comprehend it as a whole. Perhaps we can stretch the analogy to encompass hypothermia, as it can be classed into (at least) three different types, with widely varying characteristics: acute, subacute, and chronic hypothermia. These terms are somewhat arbitrary, but few doctors even think much of accidental hypothermia, much less of its disparate nature, so there is little agreement on terminology as yet. Before delving into these three diseases, however, let us detour briefly into a review of the normal physiological response to cold stress.

*I have no idea where I got this. Actually, I think the first time I heard it one of the men compared the ear to a large leaf, but if I put this in as a fourth item, it would ruin my parallel.

THE PHYSIOLOGICAL RESPONSE TO COLD

If one is thrust into a cold environment, the first response to cold is vasoconstriction or shrinking down of the skin blood vessels. This reduces heat loss from the body's core and creates an insulating layer of colder skin around the core. If one's body senses that stronger measures are required to keep the temperature of vital core organs (i.e. the heart and brain) close to normal, the metabolic rate will increase, either through work or involuntary shivering. Shivering can increase the metabolic rate and therefore heat production up to about seven times normal[3], but at the cost of exhausting one's liver and muscle glycogen, which are a human's main quick energy stores. Fatigue, the buildup of toxic waste products, may complicate this exhaustion of energy stores. At the same time shivering occurs, vasoconstriction becomes very intense; this decreases the effective size of the body's blood vessel system and the body responds by getting rid of (what seems to be) excess fluid through cold diuresis, in which the kidneys excrete copious quantities of body fluid as urine[4]. The resulting dehydration, combined with exhaustion and fatigue, may present the classic signs and symptoms of hypothermia even though the core temperature is close to normal[5]. If the cold stress isn't terminated, the body's compensatory mechanisms begin to fail, causing the core temperature to fall precipitously, producing hypothermia.

ACUTE HYPOTHERMIA AND RAPID EXTERNAL REWARMING

The scenario we have just discussed is probably the major way hypothermia develops in mountaineering and backpacking situations, but it is possible for the cold stress to be so overwhelming that normal compensatory mechanisms are totally impotent - for instance when a cross-country skier unexpectedly breaks through the ice into icy water. This immersion hypothermia may also be termed acute hypothermia (acute meaning severe and of quick onset), and develops so quickly that exhaustion, fatigue and dehydration are not conspicuous as with long, moderate cold stress. The current recommendation is for victims of cold water immersion to stay still, to huddle up to conserve energy, rather than to increase heat production, as movement in the water increases heat loss (by increased convection) more than it does production[6]. The treatment for acute hypothermia is uncontroversial: rapid, aggressive rewarming is best. The Royal Air Force recommends rewarming of the clothed victim (removal of clothes is time-consuming and dangerous for it can cause an increase in heat loss just as movement in the water can) in a tub of hot water at 45°C (115°F). For an unclothed victim, the temperature should probably be kept at about 40°C (105°F)[7,8]. Rapid rewarming, however, may in itself cause serious problems; for instance, with any external rewarming method, there is an afterdrop in core temperature: the first effect of external warmth is to return cold blood from the blood vessels of the skin to the core, further depressing the core temperature. The blood which has lain stagnant in the periphery, in addition to being chilled, has had most of its oxygen used up, and has collected toxic waste products from the hypoxic peripheral tissue. At the same time, reflex vasodilation (opening of blood vessels) of the skin expands the volume of the cardiovascular system, and cold diuresis has reduced the blood volume even in acute hypothermia, so rewarming shock may be evidenced by a drop in blood pressure (which should generally increase slowly and surely during rewarming). The combination of afterdrop, stagnant blood, and rewarming shock may be too much for the heart, resulting in cardiac arrest. A simple way to minimize these effects is to leave the victim's arms

and legs up out of the warm tub, and to rewarm the extremities only after the torso is rewarmed. Even with this caution, constant monitoring of vital signs is required, and the rate of rewarming may need to be slowed by the dilution of the hot tub water with tepid water[9]. With prompt and proper treatment of acute hypothermia the survival rate is probably better than 90%[10]. A final note: many immersion hypothermia victims cannot rewarm themselves if insulated, so active rewarming is absolutely necessary[11].

SUBACUTE HYPOTHERMIA AND INTERNAL REWARMING

Let's now go back to the scenario of physiological response to cold and pick up where we took off: now we will discuss mountain hypothermia, also known as exhaustion hypothermia because exhaustion is such a prominent feature[12]; to pin a medical term on it, we may call it subacute hypothermia (slower of onset and severity than acute hypothermia). Whatever name you give it, this type of hypothermia is the bane of wilderness travelers and mountain rescue operations. There have been various attempts to correlate signs and symptoms, core temperature, and the seriousness of hypothermia, but most such schemes are gross oversimplifications (including the one offered in Table 1 and following) and must be viewed primarily as a teaching tool rather than as a useful diagnostic or therapeutic classification. The scenario of exposure presented earlier, with core temperature normal or slightly depressed, and with strong body compensatory mechanisms, could be termed Stage I or compensated hypothermia. Stage II or crisis hypothermia is when energy reserves near depletion, and the combination of depressed core temperature and other factors severly interfere with voluntary thought and action. Stage III or decompensated hypothermia is when one's core temperature is at the mercy of the environment and drops quickly, and Stage IV hypothermia is where the body has reached an equilibrium of sorts with the environment, and is often indistinguishable from death. The factors classically associated with these stages are presented in Table 1, but let me reemphasize that this table, in its attempt to enforce order on a complicated process, may mislead if taken too seriously.

With subacute hypothermia, the problems of rapid external rewarming mentioned in the section on acute hypothermia are multiplied, and exhaustion, fatigue, and dehydration are present as primary problems in their own right[13]. Supportive care, including the reduction of cold stress, the provision of energy (glucose), and the correction of fluid and electrolyte deficits (oral or IV fluid replacements) is important, but is useless unless the victim can be rewarmed without causing further harm. One possible means to minimize the ill effects of sudden rewarming is to slow the rate of rewarming. Of course, in most mountain rescue situations, tubs are rare, so slower rewarming is a necessity, even with devices such as a hydraulic sarong or with hot packs at the groin, armpits, and neck[14,15]. However, a relatively new method of rewarming using warm, moist inspired air to rewarm from inside out seems to solve some of the problems of active external rewarming: the afterdrop is reduced by 2-3°C, and the danger of rewarming shock is much reduced. The one major criticism of the method (other than mechanical details of the aparatus) is that it does not deliver as much heat as other external methods[16]. However, loss of heat from the lungs is proportionately high in cold, dry air and the combination of rewarming and "effective insulation" makes quite a large contribution to rewarming in the field. It is possible to place a hypothermia victim in a stokes litter, insulate him with a sleeping bag and ensolite pad, add heat packs at high heat exchange areas, and put on a chemical warm air or oxygen system,

TABLE 1:

SUBACUTE ("MOUNTAIN") HYPOTHERMIA

STAGE I: COMPENSATION Core 37-35°C	• In Stage I, body heat conservation mechanisms are compensating to keep the core temperature within a few degrees of normal; it is possible to stay in Stage I for long periods of time, provided sufficient energy reserves are available. • Shivering occurs but may be stopped by an act of will. • Outer body blood vessels narrow (peripheral vasoconstriction), reducing the blood supply to superficial areas. This results in a cooler periphery, providing an insulating layer to reduce heat losses from the core. Blood flow to the extremities may reach as little as 1% of normal, but occurs as periodic "flushes" to different areas so as to prevent permanent damage (the "Hunting phenomenon".) • Blood pressure and pulse go up, reflecting the increased metabolic rate.
STAGE II: CRISIS Core 35-32°C	• In Stage II, compensatory mechanisms are strained to the point of failure. • Shivering is violent and uncontrollable, and may raise the metabolic rate to several times normal for short periods, although this uses up energy reserves at a prodigous rate. • The periodic circulation to the periphery decreases and stops. • Blood pressure and pulse may be high initially, but drop as energy reserves are exhausted. • Physical and mental coordination are greatly impaired; slurred speech and amnesia are common. • Many healthy people <u>cannot</u> regain a normal core temperature from Stage II if just insulated; additional heat must be provided. • Stage II may last only a few minutes in those who are tired or injured.
STAGE III: DECOMPENSATION Core 32-28°C	• In Stage III, compensatory mechanisms have been overwhelmed, and the core temperature drops quickly. • Shivering stops and is replaced by muscular rigidity. • Blood pressure, pulse, and respiration are weak to the point of being barely detectable. • The level of consciousness is low and little voluntary motion is seen.
STAGE IV: DEEP HYPOTHERMIA Core 28°C	• In Stage IV, a hypothermic person appears dead: he is cold, rigid, has dilated pupils, and his pulse and respiration are slow and weak if detectable at all. • Due to slow metabolism, it is possible for victims to survive long times in Stage IV without detectable circulation yet without brain damage, although heart arrest usually occurs at about 20°C, and true death follows.

thus rewarming the victim during the evacuation. If a mountain hypothermia victim is in close proximity to a tub of hot water, active external rewarming can be used effectively, but the danger is greater than with rewarming an acute hypothermia victim, and the dangers associated with rewarming increase in proportion to the time the person has been hypothermic. Patients in stage III or IV are so difficult to rewarm without complications that it would probably be best to avoid hot water immersion rewarming except in a medical facility. The use of heat packs and a chemical inhalation rewarming system would offer a much safer (but slower) means of rewarming, but for those who have been in stage III or IV for a long period, it may be safer to treat as described below under chronic hypothermia.

CHRONIC HYPOTHERMIA

Having now examined two facets of hypothermia, let us now turn to the third: chronic hypothermia, which is a decrease in core temperature over a long period of time without massive cold stress. Chronic hypothermia is more a catch-all term than a descriptive classification, but generally victims of chronic hypothermia have a depressed core temperature due to some dysfunction of thermoregulation rather than cold stress. Particularly susceptible are those with impaired central nervous system thermoregulation such as the elderly, the newborn, and those taking certain drugs; alcohol and barbiturates may cause chronic hypothermia, as may many metabolic and other diseases. The course, treatment, and outcome are more dependent on the primary disease state than on the extent of hypothermia or the core temperature, and the presentation to the rescuer may be quite varied, reflecting the differences in the primary disease. Many victims of chronic hypothermia present with a depressed level of consciousness, ketoacidosis (keto acids in the blood as in diabetic coma) with acetone or "fruity" breath, and generalized edema (swelling and puffiness of the skin). Chronic hypothermia is more a disease of urban areas than the wilderness, but mountain rescue teams may encounter chronic hypothermia in search subjects who have been lost, starving, and dehydrated for many days.[18]

The in-hospital treatment of chronic hypothermia is controversial and will probably remain so for years, but it is clear rewarming should not be attempted in the field; the victim should be insulated from further heat loss and perhaps slightly rewarmed (warm oxygen inhalation is probably safest) and gently carried out for definitive care. The metabolic imbalances are too severe, and too difficult to diagnose, for field treatment to be effective.[19]

GENERAL CARE OF HYPOTHERMIC PATIENTS

All mountain rescue team members should be familiar with the standard principles of emergency management as taught in basic Emergency Medical Technician (EMT) courses, and their adaptation to a wilderness setting, so basics such as airway management and the monitoring of vital signs will not be addressed here. However, there are several important points in the management of hypothermic patients which might not be apparent even to an experienced mountain rescue EMT or MD. Since the background

of these principles may be unclear or controversial, and yet the emergency care implications are clear and uncontroversial, they are presented in a somewhat dogmatic way. The interested reader is encouraged to go to the references for further study.

1. A cold heart is an irritable heart.

An attempt at endotracheal or esophageal obturator intubation, or even a good solid bump to the litter, may send a hypothermic heart into ventricular fibrillation. Handle hypothermic patients gently.[20]

2. Advanced life support (ALS) doesn't work on hypothermic patients.

It is impossible to defibrillate a hypothermic heart, and most emergency drugs have little or unpredictable effects on a hypothermic patient. Drugs administered to a hypothermic patient will probably all exert their effects simultaneously when the patient is rewarmed. The one prehospital ALS measure generally thought to be useful is the administration of warm normal saline or other IV fluids, but finding a good vein in a hypothermic patient is well-nigh impossible.[21]

3. Noone is dead until he's warm and dead.

Severe hypothermia mimics death.[22] If in doubt, try to resuscitate, because the brain can survive much more than the standard 4 to 6 minutes without oxygen when its metabolism is depressed by the cold.[23] In cases of cold-water immersion, anoxia survival time is even greater due to the mammalian diving reflex.[24]

4. Check carefully for a pulse.

When a hypothermic person is found, there is a vital decision to be made: does he have a pulse? If there is a pulse, even if it is very slow and can only be detected by a stethoscope, it probably is enough to supply the minimal needs of a hypothermic body. So, in a severely hypothermic patient with a pulse, the appropriate course is to insulate and to rewarm just a bit, to perhaps support ventilation slightly, but mostly to carry the patient out for definitive treatment. If, on the other hand, there is no pulse, the alternatives are to (1) start CPR and continue it as the victim is carried out, or (2) to start CPR and arrange for definitive rewarming on the spot. Starting CPR on a patient with a slow but adequate pulse will almost certainly cause the hypothermic heart to go into fibrillation; so, check carefully for a minute or so for a pulse; remember, time isn't as critical as with a warm cardiac arrest victim on the street.[25]

5. Keep the litter level.

Evidently the circulatory state of hypothermic patients, especially victims of subacute hypothermia, is quite delicate. Carrying the litter with the head elevated may be enough to cause severe convulsions and perhaps death from cerebral anoxia.[26]

CONCLUSION

For acute hypothermia, rewarm actively as quickly as possible; for moderate subacute hypothermia, rewarm actively but preferably internally, and if warm water immersion is used, it should be less agressive than with acute hypothermia rewarming; for deep subacute hypothermia and chronic hypothermia, insulate, rewarm slightly, and transport for definitive care. There, that's very neat: hypothermia treatment summarized in one sentence. However, in a manner similar to the three gentlemen from Cathay, I have presented some black-and-white answers based on scanty information about a complex subject; and in both cases, there is still a lot of grey area in between.

SHENANDOAH MOUNTAIN RESCUE GROUP
Basic Course Quiz #1: Survival and Wilderness Travel

27 Oct 81

(Note: numbers are keyed to items of the proposed Basic Standard)

1. What is the 'STOP' mnemonic, and why (and when) is it useful?

2. Briefly define:
   a. Homeostasis
   b. Fatigue

3. a. Briefly explain the role of expansion and contraction of blood vessels in the skin (vasodilation and vasoconstriction) in regulating the body's core temperature:
      i) in a cold environment
      ii) in a hot environment
   b. Explain briefly:
      i) how long periods of cold stress, which are not adequately compensated for by just vasoconstriction, affect the body
      ii) how long periods of heat stress, which are not adequately compensated for by just vasodilation, affect the body
      iii) is the problem discussed in (ii) above a problem in winter? why or why not?

4. a. List the 3 "W"s (used as a tool for teaching outdoorspeople clothing protection against hypothermia
   b. Complete the following chart, using LOW, MEDIUM, OR HIGH

	Dry Warmth	Wet Warmth
Cotton	MEDIUM	
Wool	MEDIUM	
Down	HIGH	
Fiberfill II (synthetic pile)	HIGH	

5. (Skill objective: no written question)

6. Complete the following chart, using:

Dry Cells:	Performance in Cold	Rechargeable?	Weight per Energy
Carbon-Zinc			
Alkaline	MEDIUM	SOMETIMES	HEAVY
Lithium			
Nickel-Cadmium			HEAVY
	(use HIGH or LOW)	(YES or NO)	(HEAVY or LIGHT)

7. Cyclones, also known as winter storms, and usually associated with a low-pressure system:
   a. Generally travel across the US from _____ to _____.
      (use cardinal compass headings)

b. Often have associated with them strong cold fronts and warm fronts. Comparing uncomplicated fronts, _____ fronts generally arrive more suddenly and have more severe, but shorter, associated weather.

8 - 10 (Skills objectives)

11. Give 1 example of a communicable or infectious disease common to wilderness travellers, describe the means of infection, and describe a good prevention.

12. a. What is the main treatment for localized absesses?
b. Which of the following (one, many, or all) are useful in treating allergic reactions (e.g. poison ivy or hay fever)?
_____aspirin
_____steroids (e.g. hydrocortisone)
_____antihistamines (e.g. chlorpheniramine maleate=Chlor-trimeton)
_____decongestants (e.g. pseudoephedrine=Sudafed)
c. What is the best treatment of an envenomated pit viper on the calf, in a wilderness setting?
d. What is the main treatment for diarrhea?
e. Match the following:

_____Acute hypothermia	A. Immersion in hot water
_____Mild subacute hypothermia	B. Hot drinks, food, warm body in sleeping bag
_____Chronic hypothermia	C. Insulate and transport

f. Match the following:

_____Heat cramps	A. Sodium depletion
_____Heat exhaustion	B. Dry skin and CNS signs
_____Heatstroke	C. Possibly a form of shock

13. a. What is the immediate treatment of choice for
i) small burns
ii) small frostbite
b. What is the appropriate wilderness treatment for an open fracture? (be brief)
c. What is the proper first aid treatment for shock?

14. a. List 2 <u>contraindications</u> to oral fluid replacement
b. Give:
i) a medical condition where immediate improvised evaluation is wisest
ii) a medical condition where waiting for an evaluation team is appropriate

15. (Skills objective)

SHENANDOAH MOUNTAIN RESCUE GROUP BASIC MEMBER TRAINING COURSE

TEST FOR MODULE ONE: SURVIVAL AND WILDERNESS TRAVEL

March 1982

Pick the best answer for each question. For matching questions, use each answer once only or not at all, unless otherwise directed.

1. It is possible to survive for at least a week without food; therefore, foraging for food is a low survival priority for search and rescue team members in the ASRC region.

   a. true
   b. false

2. Many of the physiological reactions to danger (e.g. increased heart rate) may be useful, but sometimes some of them may interfere with rational thinking.

   a. true
   b. false

3. The purpose of panic-stopping mnemonics (such as STOP: Stop, Think, Observe, Plan) is to provide a means to reassert the control of one's rational thinking over one's involuntary reactions.

   a. true
   b. false

4. Why is it necessary to know one's capabilities, and more importantly, one's limitations?

   a. An unrealistically optimistic view of one's capabilities may lead to situations where one is overextended. Example: You are going hand-over-hand up a 100 foot free hanging rope. Fifty feet up, you realize you don't have enough strength to reach the top or to downclimb.
   b. An unrealistically pessimistic view of one's capabilities may hamper participation in search and rescue tasks. Example: During a rescue, you must climb a very exposed section of rock (but with a good top belay). Since you are a backpacker but have never tried to climb before, you are scared shitless and tell the Field Team Leader you can't climb it. After 45 minutes of "consultation" with the FTL, you get up the climb, call "Off Belay!" and only then collapse on your face. Looking back down the climb, you realize that it is really quite trivial, but you feel that you now have a better idea of your true capabilities. Unfortunately, while you were busy with the climb, the victim managed to crawl to the hospital under his own power.
   c. both a and b sound pretty reasonable

5. There are many anecdotal stories from out west and from New England about groups of young mountaineers which got into trouble and had members of their group die. Which of the following is probably the least important factor in these disasters?

   a. the egoistic need to complete an ascent rather than to turn back in the face of bad weather
   b. cotton blue jeans
   c. inadequate clothing for wind and rain protection
   d. inadequate survival rations

6. Which of the following is a prime rule for Field Team members on all ASRC missions?

   a. DON'T GET SEPARATED FROM YOUR PACK!
   b. DON'T GET SEPARATED FROM YOUR PACK!
   c. DON'T GET SEPARATED FROM YOUR PACK!
   d. DON'T GET SEPARATED FROM YOUR PACK!

Matching (7-12)

7. Homeostatic mechanisms	a. 1000-4000 (approximately)
8. Energy level	b. buildup of waste products
9. Exhaustion	c. tend to keep something at a preset level--like a thermostat
10. Daily caloric (food energy) requirement, in kilocalories	d. about 2 up to 10 or so
11. Daily water requirement, in pints (liters)	e. buildup of waste products
12. Fatigue	f. amount of energy available for work

Matching (13-17)(answers may be used more than once)

13. highest energy per weight	a. fat
14. small amounts needed to repair damage to tissues of the body	b. sugar c. protein
15. most difficult to digest	
16. quickest available energy	
17. often craved in winter diets; use in diet may protect against cold	

18. Three primary goals in physical conditioning for search and rescue are: strength, endurance, and flexibility.

   a. true
   b. false

Matching (19-22): examples of modes of heat loss

19. conduction	a. sleeping "under the stars" rather than in the forest or in a tent
20. radiation	b. skin and lungs
21. convection	c. wind chill
22. evaporation	d. sitting on a cold rock

23. Which of the following is <u>not</u> a source of body heat loss?

   a. radiation
   b. wind chill
   c. basal metabolism
   d. respiration

24. Since water has a higher heat capacity than air, wetness causes clothes to lose their "insulating value" only because of increased evaporation heat loss.

   a. true
   b. false

Matching (25-32) (answers may be used more than once)

25. first physiologic response to cold stress
26. next physiologic response to cold stress
27. long-term consequences of the answer to 26
28. first physiologic response to heat stress
29. next physiologic response to heat stress
30. long-term consequences of the answer to 29
31. alcohol
32. tobacco

a. dehydration and salt loss
b. shivering
c. sweating
d. exhaustion
e. vasodilation: increasing blood flow to the skin
f. vasoconstriction: decreasing blood flow to the skin

33. "Hypothermia weather", a term used by outdoorspeople to describe weather which poses a great risk of hypothermia, especially for those unprepared, refers to:

a. temperatures below $0^{\circ}F$
b. temperatures below $0^{\circ}F$ with wind
c. temperatures near $32^{\circ}F$ with wind and rain
d. temperatures near $80^{\circ}F$ on a sunny beach in the Bahamas

34. "Wetchill" is the chilling effect of rain or perspiration on an outdoorsperson. Which of the following does <u>not</u> contribute to wetchill?

a. Water conducts heat faster than air, and wet clothing conducts heat faster than the same clothing dry.
b. Wet clothing causes vasodilation (increased blood flow) in the skin.
c. It takes a lot more heat to warm up a piece of wet clothing than the same garment dry.
d. Wetness causes increased evaporation heat losses.

35. The ASRC has long been pushing the idea of the "3 W's" of outdoor clothing protection for outdoorspeople in this area. These "3 W's" are:

a. wine, women, and song
b. wool, wool, and wool
c. windproof clothing, waterproof clothing, and wool or other warm-when-wet clothing
d. warm clothing, well-ventilated clothing, and well-fitting clothing

36. If you expect dry wind but no rain or snow on a winter hike, your best choice of outerwear would be:

a. a urethane-coated (waterproof) cagoule or parka.
b. a breathable (non-coated) parka of nylon, 60/40 cloth, or 65/35 cloth.
c. a knit wool sweater.

37. If you expect wind and rain on a winter hike, your best choice of outerwear would be:

a. a urethane-coated (waterproof) cagoule or parka.
b. a breathable (non-coated) parka of nylon, 60/40 cloth, or 65/35 cloth.
c. a knit wool sweater.
d. a kilt and sporran.

38. Good reasons for using the layer principle in cold weather include all of the following except:

a. Layers are easily adjusted for a comfortable temperature level.
b. Multiple layers are more water-resistant than a single layer.
c. Multiple layers trap air and therefore provide better insulation than a single equivalently heavy layer.

39. Ventilation, dressing so that one is slightly chilly, rather than warm, and stopping to take off layers of clothing when warm are essential for travel in cold weather. Why is it so important to avoid overheating?

a. to avoid heat exhaustion and heat cramps
b. to avoid eclampsia
c. to avoid wet clothing
d. to avoid heatstroke

40. For mountain rescue uses, the wicking of water by cotton clothes is:

a. desirable because of the feeling of comfort it provides.
b. undesirable because if one part of a cotton garmentis exposed to rain, the entire garmentbecomes soaked.
c. irrelevant.

41. Wool and certain synthetics, like polypropylene, retain a fair amount of their insulating value when wet. On the other hand, cotton and down are almost useless as insulation when wet.

a. true
b. halse

42. Alkaline cells perform fairly well in the cold. Compared to alkaline cells, the cold performance of carbon-zinc cells is _____, and that of nickel-cadmium and lithium cells is _____.

a. better, worse
b. better, better
c. worse, better
d. worse, worse

43. Compared to alkaline cells, lithium cells have the advantage that they are _____, and nickel-cadmium cells have the advantage that they are _____.

a. not as dangerous, lighter
b. much lighter, rechargeable
c. longer lived, much cheaper per cell
d. rechargeable, long lived

44. In the ridge-and-valley province of Virginia, weather usually comes in from the _____; this is probably due to the prevailing _____ path of winter storms (cyclones) across the US.

a. east, east-to-west
b. west, west-to-east
c. south, south-to-north
d. top, left-to-right

45. A sudden shange in wind direction, sometimes visibly heralded by trees showing the light-colored undersides of their leaves, often precededes the arrival of a local storm.

a. true
b. false

46. Cold fronts generally bring with them sudden, violent weather; warm fronts usually bring overcast and periods of rain.

a. true
b. false

Matching (47-51)

47. Rocky Mountain spotted fever	a. puncture wounds
48. Tetanus	b. fecal contamination in water
49. enteritis and diarrhea	c. animal bites
50. Rabies	d. areas grazed by cattle
51. chiggers	e. ticks

52. The correct treatment for muscle cramps may includeall of the following except:

a. warmth
b. antihistamines
c. stretching
d. massage

53. As a general rule, the top layer of a friction blister (e.g. on the heel) should be removed.

a. true
b. false

54. The main field treatment for tendonitis (i.e. "squeak heel", "mal de recquette") is: (1) remove the cause (e.g. get a new pair of boots which don't press on the heel tendon), (2) rest, and (3) aspirin to reduce inflammation.

a. true
b. false

55. An important and/essential part of the treatment of any abscess (a closed collection of pus, a boil) is:

a. oral antibiotics.
b. incision and drainage.
c. warm soaks.
d. aspirin.

56. Severe contact dermatitis, such as from a bad case of poison ivy, may be appropiately treated with:

a. aspirin.
b. steroid cream (cortisone).
c. oral antihistamines.
d. all of the above

57. The best field treatment for any allergic reaction is an immediate subcutaneous (or intravenous) injection of 10 cc of 1:1000 adrenaline (epinephrine).

a. true
b. false

58. In an anaphylactic reaction, the major medical problems are usually shock and swelling of the airways.

a. true
b. false

59. The proper management of a suspected pit-viper snakebite in the backcountry includes:

a. immediate incision and suction of the backcountry.
b. packing in ice.
c. tourniquet application.
d. immediate cross-shaped incision and suction, especially if the bite is on the hands or feet.
e. check carefully for signs of envenomation (warmth, redness, pain).

60. Any mammal bite must be treated as urgent medical problem, because it is potential source of rabies, even though rabies has a long incubation period.

a. true
b. false

61. Fever by itself is not a problem unless it exceeds about 104°F (about 40°C), but it may indicate an underlying problem which must be addressed.

a. true
b. false

62. The major treatment for vomiting and diarrhea is fluid replacement.

a. true
b. false

63. The major treatment for snowblindness is patching of the eyes and rest.

a. true
b. false

64. When a hypothermia patient is rapidly rewarmed:

a. "afterdrop", a paradoxical cooling of the core temperature below its already low temperature, may develop.
b. cold, ~~poisonous~~ blood from the cold extremities may rush back to the heart, causing it to stop beating normally.
c. excessive vasodilation of the skin blood vessels from the heat may cause a form of shock.
d. all of the above are true

65. A person ~~in Stage II~~ subacute (mountain) hypothermia, ~~with~~ uncontrollable shivering, should be put in dry clothing and a dry winter sleeping bag to rewarm himself.

a. true
b. false

66. Which of the following is not a good place to put hot packs when rewarming a hypothermic person?

a. neck
b. groin
c. armpits
d. calves

67. A person with severe chronic hypothermia is in danger of having heart problems; therefore you must be very careful to bump or jostle such a victim.

a. true
b. false

68. Heat cramps are caused by a lack of salt. The treatment is to give something to drink which contains a little (but not a lot) of salt.

a. true
b. false

69. Of the following, the best and most reliable indicator of dehydration is:

a. thirst.
b. dark, concentrated urine.
c. delirium.
d. flushed skin.

70. A good rule for a hot environment is:

a. Conserve your water, and ration it out; you may need it later.
b. Ration your sweat, not your water.
c. water the flowers.

71. In winter, dehydration is seldom a problem because the body uses less water than in a hot environment.

a. true
b. false

72. Dizziness, weakness, tunnel vision, and dark urine probably indicate:

a. heatstroke.
b. heat exhaustion.
c. dehydration.
d. heat cramps.

73. In many ways, heat exhaustion is similar to shock.

a. true
b. false

74. Heatstroke is characterized by:

a. hot, cry skin.
b. cool, clammy skin and a rapid pulse.
c. neither of the above answers are true

75. _____ is a true medical emergency requiring immediate treatment to bring the victim's temperature down.

a. heatstroke
b. heat exhaustion
c. dehydration.
d. heat cramps.

76. The extreme pain of blood under a fingernail after a crush injury (subungual hematoma) may be greatly relieved by drilling or burning a hole through the fingernail to let the blood out.

a. true
b. false

77. The proper treatment for an external ear infection will probably include the local application of antibiotic ointment.

a. true
b. false

78. The proper treatment for a middle ear (behind the eardrum) infection will probably include the use of a decongestant and possibly an antihistamine.

a. true
b. false

79. Conjunctivitis (inflammation of the lining of the eye and eyelids) may be caused by:

a. an allergy. The proper treatment includes the use of an antihistamine.
b. a foreign body in the eye (actually, in the conjunctival sac). The proper treatment includes removal of the offending object (with the aid of a local anaestheic if possible), application of antibiotic opthalmic ointment, and an eye patch.
c. a mild abrasion of the eye. The proper treatment includes the examination of the eye carefully for a foreign body, application of opthalmic antibiotic ointment, and an eye patch.
d. all of the above are true.

80. The proper immediate treatment for small second degree burns is:

a. ointment such as Neosporin or other antibiotic ointment.
b. immersion in cold water, then application of a dry sterile dressing, POSSIBLY
c. oral antibiotics.
d. butter or lard on the burn.

81. A good treatment for deep frostbite is to rub the affected area with a warm hand to increase the blood flow.

a. true
b. false

82. Since re-freezing of a frostbitten part is extremely damaging, frostbitten parts should not be rewarmed if there is a good chance of further freezing.

a. true
b. false

83. A person with frozen feet may walk on them with little additional damage.

a. true
b. false

84. The recommended treatment for deep frostbite is immediate rewarming in water heated to 100°C (212°F).

a. true
b. false

85. The proper definitive care of minor wounds in the field (minor wounds means no sutures or butterfly strips necessary) includes all of the following except:

a. Clean the wound with clean water, perhaps with a little mild soap added.
b. Remove any small bits of tissue which will obviously die.
c. Apply tincture of iodine, merthiolate, or alcohol to the area.
d. Apply a sterile dressing.

86. If you are presented in the backcountry around here, with a major wound which will need to be cared for by a surgeon, you probably should not try to get the wound completely clean, as you might cause damage, and the surgeon will want to clean the wound himself in any case.

a. true
b. false

87. The ideal treatment for a sprained ankle includes all of the following except:

(continued)

(87) a. aspirin
b. application of cold packs for 24 hours followed by hot packs
c. an elastic bandage around the ankle (taking care not to cut off circulation)
d. steroid cream to the ankle
e. slight elevation for 24 hours

88. In the field, dislocations should generally be treated as would a fracture: splint and transport to a hospital. In which of the following would it not be reasonable to attempt reduction in the field?

a. dislocation of the jaw
b. anterior dislocation of the shoulder with no pulse, movement, or feeling in the arm
c. posterior dislocation of the hip

89. The correct treatment for muscle strains or contusions is elevation, cold compresses for 24 hours, and then occasional hot compresses.

a. true
b. false

90. The general rules of thumb for splinting include:

a. Splint it as it lies.
b. For a fracture of a long bone, immobilize the joint above and the joint below.
c. For a fracture around a joint, immobilize the long bones on either side.
d. all of the above

91. The proper treatment of an open fracture, far in the backcountry, includes meticulous cleaning, a sterile dressing, and antibiotics.

a. true
b. false

92. Which of the following is not part of the proper treatment for shock?

a. Position the person lying but with the legs elevated if possible
b. Keep the person from chilling.
c. IF the person has no chest or abdominal wounds or injuries AND the person is completely conscious AND it will be many hours until you can get him to medical care, you may give him small sips of an electrolyte replacement such as water with a bit of salt in it.
d. Give small sips of whiskey.

93. The proper treatment for an attached tick is not to pull it out, but but to persuade it to let go by covering it with vaseline or goosing its rear end with a hot object.

a. true
b. false

94. A good treatment for embedded chiggers is to coat the skin over them with clear nail polish and thus to suffocate them.

a. true
b. false

95. Which of the following is a good reason to begin immediate evacuation with an improvised litter, rather than waiting for a rescue team with a Stokes (assuming you're just out hiking)?

a. signs of deepening stupor and coma following a blow to the head
b. a femur (thigh) fracture without severe shock
c. a spine fracture
d. a heart attack

Δ5 3β-OL PATHWAY OVARY SYNDMA
Δ4 3β-ONE PATHWAY FOLLICULAR

ERRATA + ~~ADDENDA~~
TEST FOR MODULE 1

QUESTION	CHANGE
#15	CHANGE TO "WHICH OF THE FOLLOWING PROBABLY CONTRIBUTED LEAST TO THESE DISASTERS?"
#'s 7-12	CHANGE ANSWER (c.) TO: "DEPLETION OF ENERGY STORES"
#41(b)	b. IS "false"
~~#45~~	~~"A SUDDEN CHANGE ... PRECEDES"~~
#64 b.	"b. COLD BLOOD, WITH LITTLE OXYGEN AND MUCH METABOLIC WASTE, MAY SUDDENLY BE RETURNED TO THE CORE FROM THE EXTREMITIES, CAUSING THE HEART TO ~~STOP~~ BEAT ABNORMALLY OR TO STOP.
#67	"... BE VERY CAREFUL NOT TO BUMP ...."
#74 a.	"hot, dry SKIN."
#79 b.	"ANTESTHETIC"
#86	IT IS LATE AUGUST. 86. YOU ARE HIKING IN A WILDERNESS AREA IN WEST VIRGINIA. YOU FIND A HIKER WHO HAS JUST SUSTAINED (A DEEP GASH IN THE CALF ~~AN OPEN FRACTURE OF THE FEMUR~~) (~~AND BLEEDING. YOU BELIEVE THAT YOU CAN GET~~) WHICH WILL OBVIOUSLY REQUIRE SURGICAL CLOSURE. YOU STOP THE BLEEDING, ~~AND BANDAGED~~ YOUR JUDGEMENT IS, THAT YOU CAN GET THE VICTIM OUT TO THE ROAD AND TO GRANT MEMORIAL HOSPITAL IN PETERSBURG, W.V. IN ABOUT 10 HOURS. ~~YOUR SHOULD BE~~
(FAMILY CLOSE)	IN THIS SITUATION, YOU SHOULD:
	a. MERELY PLACE A PRESSURE BANDAGE ON THE WOUND AND TRANSPORT. TRYING TO CLEAN THE WOUND ~~CONTAMINATION~~ COMPLETELY MAY CAUSE DAMAGE, AND THE PHYSICIAN WILL PROBABLY ~~SURGEON~~ WANT TO CLEAN IT HIMSELF ANYWAY.

KEY

SHENANDOAH MOUNTAIN RESCUE GROUP BASIC MEMBER TRAINING COURSE

TEST FOR MODULE ONE: SURVIVAL AND WILDERNESS TRAVEL

March 1982

Pick the best answer for each question. For matching questions, use each answer once only or not at all, unless otherwise directed.

1. It is possible to survive for at least a week without food; therefore, foraging for food is a low survival priority for search and rescue team members in the ASRC region.

   (a.) true
   b. false

2. Many of the physiological reactions to danger (e.g. increased heart rate) may be useful, but sometimes some of them may interfere with rational thinking.

   (a.) true
   b. false

3. The purpose of panic-stopping mnemonics (such as STOP: Stop, Think, Observe, Plan) is to provide a means to reassert the control of one's rational thinking over one's involuntary reactions.

   (a.) true
   b. false

4. Why is it necessary to know one's capabilities, and more importantly, one's limitations?

   a. An unrealistically optimistic view of one's capabilities may lead to situations where one is overextended. Example: You are going hand-over-hand up a 100 foot free hanging rope. Fifty feet up, you realize you don't have enough strength to reach the top or to downclimb.
   b. An unrealistically pessimistic view of one's capabilities may hamper participation in search and rescue tasks. Example: During a rescue, you must climb a very exposed section of rock (but with a good top belay). Since you are a backpacker but have never tried to climb before, you are scared shitless and tell the Field Team Leader you can't climb it. After 45 minutes of "consultation" with the FTL, you get up the climb, call "Off Belay!" and only then collapse on your face. Looking back down the climb, you realize that it is really quite trivial, but you feel that you now have a better idea of your true capabilities. Unfortunately, while you were busy with the climb, the victim managed to crawl to the hospital under his own power.
   (c.) both a and b sound pretty reasonable

5. There are many anecdotal stories from out west and from New England about groups of young mountaineers which got into trouble and had members of their group die. Which of the following ~~is probably the~~ least ~~important factor in~~ TO these disasters? PROBABLY CONTRIBUTING

   a. the egoistic need to complete an ascent rather than to turn back in the face of bad weather
   b. cotton blue jeans
   c. inadequate clothing for wind and rain protection
   (d.) inadequate survival rations

6. Which of the following is a prime rule for Field Team members on all ASRC missions?

ANY OR ALL
a. DON'T GET SEPARATED FROM YOUR PACK!
b. DON'T GET SEPARATED FROM YOUR PACK!
c. DON'T GET SEPARATED FROM YOUR PACK!
d. DON'T GET SEPARATED FROM YOUR PACK!

Matching (7-12)

C 7. Homeostatic mechanisms
F 8. Energy level
E 9. Exhaustion
A 10. Daily caloric (food energy) requirement, in kilocalories
D 11. Daily water requirement, in pints (liters)
B 12. Fatigue

a. 1000-4000 (approximately)
b. buildup of waste products
c. tend to keep something at a preset level--like a thermostat
d. about 2 up to 10 or so
e. ~~buildup of waste products~~ DEPLETION OF ENERGY STORES
f. amount of energy available for work

Matching (13-17)(answers may be used more than once)

A 13. highest energy per weight
C 14. small amounts needed to repair damage to tissues of the body
A 15. most difficult to digest
B 16. quickest available energy
A 17. often craved in winter diets; use in diet may protect against cold

a. fat
b. sugar
c. protein

18. Three primary goals in physical conditioning for search and rescue are: strength, endurance, and flexibility.

(a.) true
b. false

Matching (19-22): examples of modes of heat loss

D 19. conduction
A 20. radiation
C 21. convection
B 22. evaporation

a. sleeping "under the stars" rather than in the forest or in a tent
b. skin and lungs
c. wind chill
d. sitting on a cold rock

23. Which of the following is not a source of body heat loss?

a. radiation
b. wind chill
(c.) basal metabolism
d. respiration

24. Since water has a higher heat capacity than air, wetness causes clothes to lose their "insulating value" only because of increased evaporation heat loss.

a. true
(b.) false

SMRG Basic Course — Test for Module 1

Matching (25-32) (answers may be used more than once)

F 25. first physiologic response to cold stress
B 26. next physiologic response to cold stress
D 27. long-term consequences of the answer to 26
E 28. first physiologic response to heat stress
C 29. next physiologic response to heat stress
A 30. long-term consequences of the answer to 29
E 31. alcohol
F 32. tobacco

a. dehydration and salt loss
b. shivering
c. sweating
d. exhaustion
e. vasodilation: increasing blood flow to the skin
f. vasoconstriction: decreasing blood flow to the skin

33. "Hypothermia weather", a term used by outdoorspeople to describe weather which poses a great risk of hypothermia, especially for those unprepared, refers to:

a. temperatures below 0°F
b. temperatures below 0°F with wind
(c.) temperatures near 32°F with wind and rain
d. temperatures near 80°F on a sunny beach in the Bahamas

34. "Wetchill" is the chilling effect of rain or perspiration on an outdoorsperson. Which of the following does not contribute to wetchill?

a. Water conducts heat faster than air, and wet clothing conducts heat faster than the same clothing dry.
(b.) Wet clothing causes vasodilation (increased blood flow) in the skin.
c. It takes a lot more heat to warm up a piece of wet clothing than the same garment dry.
d. Wetness causes increased evaporation heat losses.

35. The ASRC has long been pushing the idea of the "3 W's" of outdoor clothing protection for outdoorspeople in this area. These "3 W's" are:

a. wine, women, and song
b. wool, wool, and wool
(c.) windproof clothing, waterproof clothing, and wool or other warm-when-wet clothing
d. warm clothing, well-ventilated clothing, and well-fitting clothing

36. If you expect dry wind but no rain or snow on a winter hike, your best choice of outerwear would be:

a. a urethane-coated (waterproof) cagoule or parka.
(b.) a breathable (non-coated) parka of nylon, 60/40 cloth, or 65/35 cloth.
c. a knit wool sweater.

37. If you expect wind and rain on a winter hike, your best choice of outerwear would be:

a. a urethane-coated (waterproof) cagoule or parka.
b. a breathable (non-coated) parka of nylon, 60/40 cloth, or 65/35 cloth.
c. a knit wool sweater.
d. a kilt and sporran.

38. Good reasons for using the layer principle in cold weather include all of the following except:

a. Layers are easily adjusted for a comfortable temperature level.
b. Multiple layers are more water-resistant than a single layer.
c. Multiple layers trap air and therefore provide better insulation than a single equivalently heavy layer.

39. Ventilation, dressing so that one is slightly chilly rather than warm, and stopping to take off layers of clothing when warm are essential for travel in cold weather. Why is it so important to avoid overheating?

a. to avoid heat exhaustion and heat cramps
b. to avoid eclampsia
c. to avoid wet clothing
d. to avoid heatstroke

40. For mountain rescue uses, the wicking of water by cotton clothes is:

a. desirable because of the feeling of comfort it provides.
b. undesirable because if one part of a cotton garment is exposed to rain, the entire garment becomes soaked.
c. irrelevant.

41. Wool and certain synthetics, like polypropylene, retain a fair amount of their insulating value when wet. On the other hand, cotton and down are almost useless as insulation when wet.

a. true
b. false

42. Alkaline cells perform fairly well in the cold. Compared to alkaline cells, the cold performance of carbon-zinc cells is _____, and that of nickel-cadmium and lithium cells is _____.

a. better, worse
b. better, better
c. worse, better
d. worse, worse

43. Compared to alkaline cells, lithium cells have the advantage that they are _____, and nickel-cadmium cells have the advantage that they are _____.

a. not as dangerous, lighter
b. much lighter, rechargeable
c. longer lived, much cheaper per cell
d. rechargeable, long lived

44. In the ridge-and-valley province of Virginia, weather usually comes in from the _____; this is probably due to the prevailing _____ path of winter storms (cyclones) across the US.

a. east, east-to-west
b. west, west-to-east
c. south, south-to-north
d. top, left-to-right

45. A sudden change in wind direction, sometimes visibly heralded by trees showing the light-colored undersides of their leaves, often precedes the arrival of a local storm.

a. true
b. false

46. Cold fronts generally bring with them sudden, violent weather; warm fronts usually bring overcast and periods of rain.

a. true
b. false

Matching (47-51)

47. Rocky Mountain spotted fever	a. puncture wounds
48. Tetanus	b. fecal contamination in water
49. enteritis and diarrhea	c. animal bites
50. Rabies	d. areas grazed by cattle
51. chiggers	e. ticks

52. The correct treatment for muscle cramps may include all of the following except:

a. warmth
b. antihistamines
c. stretching
d. massage

53. As a general rule, the top layer of a friction blister (e.g. on the heel) should be removed.

a. true
b. false

54. The main field treatment for tendonitis (i.e. "squeak heel", "mal de racquette") is: (1) remove the cause (e.g. get a new pair of boots which don't press on the heel tendon), (2) rest, and (3) aspirin to reduce inflammation.

a. true
b. false

55. An important and essential part of the treatment of any abscess (a closed collection of pus, a boil) is:

a. oral antibiotics.
b. incision and drainage.
c. warm soaks.
d. aspirin.

56. Severe contact dermatitis, such as from a bad case of poison ivy, may be appropiately treated with:

a. aspirin.
b. steroid cream (cortisone).
c. oral antihistamines.
(d.) all of the above

57. The best field treatment for any allergic reaction is an immediate subcutaneous (or intravenous) injection of 10 cc of 1:1000 adrenaline (epinephrine).

a. true
(b.) false

58. In an anaphylactic reaction, the major medical problems are usually shock and swelling of the airways.

(a.) true
b. false

59. The proper management of a suspected pit-viper snakebite in the backcountry includes:

a. immediate incision and suction of the backcountry.
b. packing in ice.
c. tourniquet application.
d. immediate cross-shaped incision and suction, especially if the bite is on the hands or feet.
(e.) check carefully for signs of envenomation (warmth, redness, pain).

60. Any mammal bite must be treated as urgent medical problem, because it is potential source of rabies, even though rabies has a long incubation period.

(a.) true
b. false

61. Fever by itself is not a problem unless it exceeds about 104°F (about 40°C), but it may indicate an underlying problem which must be addressed.

(a.) true
b. false

62. The major treatment for vomiting and diarrhea is fluid replacement.

(a.) true
b. false

63. The major treatment for snowblindness is patching of the eyes and rest.

(a.) true
b. false

64. When a hypothermia patient is rapidly rewarmed:

a. "afterdrop", a paradoxical cooling of the core temperature below its already low temperature, may develop.
b. cold, ~~poisonous~~ blood from the cold extremities may rush back to the heart, causing it to stop beating normally.
c. excessive vasodilation of the skin blood vessels from the heat may cause a form of shock.
d. all of the above are true

65. A person in Stage II subacute (mountain) hypothermia, with uncontrollable shivering, should be put in dry clothing and a dry winter sleeping bag to rewarm himself.

a. true
b. false

66. Which of the following is <u>not</u> a good place to put hot packs when rewarming a hypothermic person?

a. neck
b. groin
c. armpits
d. calves

67. A person with severe chronic hypothermia is in danger of having heart problems; therefore you must be very careful to bump or jostle such a victim.

a. true
b. false

68. Heat cramps are caused by a lack of salt. The treatment is to give something to drink which contains a little (but not a lot) of salt.

a. true
b. false

69. Of the following, the best and most reliable indicator of dehydration is:

a. thirst.
b. dark, concentrated urine.
c. delirium.
d. flushed skin.

70. A good rule for a hot environment is:

a. Conserve your water, and ration it out; you may need it later.
b. Ration your sweat, not your water.
c. water the flowers.

71. In winter, dehydration is seldom a problem because the body uses less water than in a hot environment.

a. true
b. false

72. Dizziness, weakness, tunnel vision, and dark urine probably indicate:

a. heatstroke.
b. heat exhaustion.
c. dehydration.
d. heat cramps.

73. In many ways, heat exhaustion is similar to shock.

a. true
b. false

74. Heatstroke is characterized by:

a. hot, dry skin.
b. cool, clammy skin and a rapid pulse.
c. neither of the above answers are true

75. _____ is a true medical emergency requiring immediate treatment to bring the victim's temperature down.

a. heatstroke
b. heat exhaustion
c. dehydration.
d. heat cramps.

76. The extreme pain of blood under a fingernail after a crush injury (subungual hematoma) may be greatly relieved by drilling or burning a hole through the fingernail to let the blood out.

a. true
b. false

77. The proper treatment for an external ear infection will probably include the local application of antibiotic ointment.

a. true
b. false

78. The proper treatment for a middle ear (behind the eardrum) infection will probably include the use of a decongestant and possibly an antihistamine.

a. true
b. false

79. Conjunctivitis (inflammation of the lining of the eye and eyelids) may be caused by:

a. an allergy. The proper treatment includes the use of an antihistamine.
b. a foreign body in the eye (actually, in the conjunctival sac). The proper treatment includes removal of the offending object, with the aid of a local anaesthetic if possible, application of antibiotic opthalmic ointment, and an eye patch.
c. a mild abrasion of the eye. The proper treatment includes the examination of the eye carefully for a foreign body, application of opthalmic antibiotic ointment, and an eye patch.
d. all of the above are true.

80. The proper immediate treatment for small second degree burns is:

a. ointment such as Neosporin or other antibiotic ointment.
b. immersion in cold water, then application of a dry sterile dressing.
c. oral antibiotics.
d. butter or lard on the burn.

81. A good treatment for deep frostbite is to rub the affected area with a warm hand to increase the blood flow.

a. true
b. false

82. Since re-freezing of a frostbitten part is extremely damaging, frostbitten parts should not be rewarmed if there is a good chance of further freezing.

a. true
b. false

83. A person with frozen feet may walk on them with little additional damage.

a. true
b. false

84. The recommended treatment for deep frostbite is immediate rewarming in water heated to 100°C (212°F).

a. true
b. false

85. The proper definitive care of minor wounds in the field (minor wounds means no sutures or butterfly strips necessary) includes all of the following except:

a. Clean the wound with clean water, perhaps with a little mild soap added.
b. Remove any small bits of tissue which will obviously die.
c. Apply tincture of iodine, merthiolate, or alcohol to the area.
d. Apply a sterile dressing.

86. If you are presented, in the backcountry around here, with a major wound which will need to be cared for by a surgeon, you probably should not try to get the wound completely clean, as you might cause damage, and the surgeon will want to clean the wound himself in any case.

a. true
b. false

87. The ideal treatment for a sprained ankle includes all of the following except:

(continued)

(87) a. aspirin
b. application of cold packs for 24 hours followed by hot packs
c. an elastic bandage around the ankle (taking care not to cut off circulation)
d. steroid cream to the ankle
e. slight elevation for 24 hours

88. In the field, dislocations should generally be treated as would a fracture: splint and transport to a hospital. In which of the following would it not be reasonable to attempt reduction in the field?

a. dislocation of the jaw
b. anterior dislocation of the shoulder with no pulse, movement, or feeling in the arm
c. posterior dislocation of the hip

89. The correct treatment for muscle strains or contusions is elevation, cold compresses for 24 hours, and then occasional hot compresses.

a. true
b. false

90. The general rules of thumb for splinting include:

a. Splint it as it lies.
b. For a fracture of a long bone, immobilize the joint above and the joint below.
c. For a fracture around a joint, immobilize the long bones on either side.
d. all of the above

91. The proper treatment of an open fracture, far in the backcountry, includes meticulous cleaning, a sterile dressing, and antibiotics.

a. true
b. false

92. Which of the following is not part of the proper treatment for shock?

a. Position the person lying but with the legs elevated if possible.
b. Keep the person from chilling.
c. IF the person has no chest or abdominal wounds or injuries AND the person is completely conscious AND it will be many hours until you can get him to medical care, you may give him small sips of an electrolyte replacement such as water with a bit of salt in it.
d. Give small sips of whiskey.

93. The proper treatment for an attached tick is not to pull it out, but but to persuade it to let go by covering it with vaseline or goosing its rear end with a hot object.

a. true
b. false

94. A good treatment for embedded chiggers is to coat the skin over them with clear nail polish and thus to suffocate them.

a. true
b. false

95. Which of the following is a good reason to begin immediate evacuation with an improvised litter, rather than waiting for a rescue team with a Stokes (assuming you're just out hiking)?

a. signs of deepening stupor and coma following a blow to the head
b. a femur (thigh) fracture without severe shock
c. a spine fracture
d. a heart attack