

MGH Wilderness Medicine Fellowship Curriculum

Approved by Partners GME Office

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Topics and Techniques:

Wilderness medicine is defined by the practice of medicine in resource-limited, austere environments -- not exclusively by distance from human population centers. The skills taught by our Fellowship have broad and unique application: in wilderness areas, pre-hospital care, disaster medicine, international and developing-world projects, and environmental/medical policy. The MGH Wilderness Medicine Fellowship is a one year program.

The critical cognitive knowledge and skills taught by our Fellowship are imparted through a range of organized didactic, research, and clinical experiences.

There are **five critical, longitudinal components** that all fellows are mandated to complete:

- 1) **Didactics/ Seminar: 12 curriculum modules**
- 2) **Core Clinical Experience**
- 3) **Research Skills/Topics**
- 4) **Wilderness Technical Skills.**
- 5) **Leadership Skills**

I. Didactics -- 12 Wilderness Medicine Fellowship Teaching Modules:

Effective practice of wilderness medicine requires mastery of a large, discrete body of cognitive knowledge. The pedagogical backbone of the MGH Wilderness Medicine Fellowship Curriculum is structured through **12 primary topic modules**. These modules allow fellows to master the breadth and depth of cognitive knowledge required to competently practice wilderness medicine.

Each module is taught through two 90 minute, biweekly seminars conducted by WM Division staff. These meetings are open to residents, staff, and other members of the MGH EM community.

Together, these modules cover in detail the critical cognitive skills and procedures that fellows are to have mastered by the completion of the fellowship. Each of these modules is comprised of required reading (from the leading text of the field, Auerbach's 2316 page, *Wilderness Medicine*, additional monographs, key articles from the medical literature, and reading selections from world literature). The seminar format allows fellows opportunity for discussion and synthesis of these ideas. For many of these modules, there is an associated field, experiential education, or research experience that accompanies.

Additionally, Grand Rounds guest lectures augment our wilderness medicine fellowship teaching. These speakers are of international authority, and their lectures are open not only to fellows and the entire HAEMR residency, but to the entire MGH community. Prior speakers have been welcomed as part of MGH EM/ IM grand rounds, and are available for meals, career planning, and research discussions in the days before and after speaking. We anticipate continuing this tradition.

Module 1 Wilderness, Global Health, Good Books, and Physicians

Reading: see attached **appendix B, “Wilderness, Global Health, Good Books, and Physicians.”**

The Practice of the Wild: Essays. Gary Snyder.

Sand County Almanac. Aldo Leopold.

The Wilderness Act of 1964 ([Pub.L.](#) 88-577)

Additionally, fellows may choose any two texts from the attached bibliography.

In preparation for teaching the attached course overview, fellows must complete the required reading and read at least two additional books noted in the bibliography. During this seminar, fellows will be responsible for helping discuss each of the works noted. In so doing, they should be able to trace the intellectual evolution of ‘wilderness’ and human culture’s interaction with the nature world through the lens of both science/policy and of literature.

As described in the handout, I intend this module:

- 1) To expose the fellow to the wide range of literature that investigates mankind’s relationship with the natural world.
- 2) To help facilitate a conversation about the role and responsibility of the modern physician and organized medicine in respect to ‘environmental’ issues.
- 3) To engender a sense of awareness about the important role that practicing physicians can play in advocating for local and global environmental issues.

Module 2 Mountain Medicine – High altitude, lightning, avalanche

Reading Auerbach’s Wilderness Medicine. Chapters: 1-3

Additional reading:

Swenson ER, Maggiorini M, Mongovin S, Gibbs JS, Greve I, Mairbäurl H, Bärtsch P. JAMA. 2002 May 1;287(17):2228-35.

[Allemann Y](#), [Hutter D](#), [Lipp E](#), [Sartori C](#), [Duplain H](#), [Egli M](#), [Cook S](#), [Scherrer U](#), [Seiler C](#) **Patent foramen ovale and high-altitude pulmonary edema.** [JAMA](#). 2006 Dec 27;296(24):2954-8.

[Fagenholz PJ](#), [Gutman JA](#), [Murray AF](#), [Noble VE](#), [Thomas SH](#), [Harris NS](#) **Chest ultrasonography for the diagnosis and monitoring of high-altitude pulmonary edema.** [Chest](#). 2007 Apr;131(4):1013-8.

Fagenholz PJ, Gutman JA, Murray AF, Noble VE, Camargo CA Jr., Harris NS **Optic nerve sheath diameter correlates with the presence and severity of acute mountain sickness: evidence for increased intracranial pressure.** [J Appl Physiol](#). 2009 Apr;106(4):1207-11.

1. High altitude (for each section to follow, are listed, Key Goals for Discussion)
 - a) Acute/chronic response to hypobaric hypoxia by organ system
 - b) Medical interventions and pharmacology: diamox, dexamethasone, PGE2 inhibitors
 - c) Key diagnostic criteria and treatment for acute mountain sickness, HAPE, HACE
 - d) Current state of the art research topics (AMS etiology, HAPE/ HPVR mediators)
2. Lightning
 - a) Characteristics of lightning current and pathophysiologic findings that result.
 - b) Compare and contrast with electrocution injury (AC/DC)
 - c) Lightning safety: reverse triage, scene safety, 30/30 rule
3. Avalanche
 - a) Risk factors: snow, weather, environmental properties associated with avalanche danger: temperature gradient, evolution of snow weathering, snow and wind loading of slopes, angle and topography of underlying strata
 - b) Primary modes of injury/death from avalanche
 - c) Avalanche safety/rescue: single person vs. multiple person rescues, avalanche beacon systems, safe travel in avalanche prone settings

Module 3 Heat and Cold:

Reading: Auerbach's Chapter 4-11

Additional Reading, "The Cremation of Sam McGee," Robert Service

1. Thermoregulation
 - a) Role of CNS, skin, vasculature, and lungs in response to cold stimulus
 - b) Key exogenous influences on cold regulation: hydration, altitude, hypoxia, alcohol
 - c) Role of different insulations (down/synthetic/open vs. closed cell foam)
 - d) Role of conduction/ convection/ radiation
 - e) Avoidance/group dynamics in the field
2. Hypothermia/ Immersion Injury
 - a) Key findings of different core body temperatures: physical findings, EKG
 - b) Therapeutics for active rewarming: CPR, medications, tools
 - c) Methods for re-warming: field vs. hospital
 - d) State of the art practice (extracorporeal resuscitation, International Hypothermia Registry)
3. Non-freezing cold injury
 - a) Chilblains – avoidance, role of hygiene, treatment
 - b) Long term deficits caused by
4. Frostbite
 - a) Risk factors, prophylaxis
 - b) Degrees of frostbite 1/2/3rd degree – exam finding
 - c) Therapeutic interventions
 - d) Long term management and deficits
5. Heat Related Injury
 - a) Heat exhaustion vs. heat stroke

- b) Risk factors, group dynamics to reduce risk
- c) Field vs. hospital based therapeutics

Module 4 Burns, Fire, Radiation

Reading Auerbach's Chapters: 12-15

Additional reading: "Fire and Ice," Robert Frost

1. Wildland Fires

- a) Factors influencing wildland fires: topography, plant cover, prior burn history, seasonal effects, local weather, human habitation, and human intervention.
- b) Dynamics of different forms of wildland fires: ground vs. crown
- c) Avoidance/safety.
- d) Public policy considerations.

2. Care of Burn Injuries

- a) Risk factors, prophylaxis (clothing choices/ gear)
- b) Degrees of burn: 1/2/3rd/4th degree – exam findings.
- c) Therapeutic interventions for each.
- d) Prognosis associated with each.

3. Solar Radiation Injury

- a) Risk factors, prophylaxis, pathophysiology of UV exposure.
- b) Degrees of burn 1/2 degree – exam findings.
- c) Therapeutic interventions.
- d) Long term effects of acute and prolonged UV exposure.
- e) Acute UV keratitis.

4. Volcanic Eruption

- a) Geology, plate tectonics, geophysics associated
- b) Associated phenomena: Lahars, blast eruptions, tsunami, pyroclastic flows.
- c) History of significant eruptions (Italy, Indonesia, Oregon, Iceland)
- d) Typical injury patterns (burn, ballistic, asphyxiation, global weather changes/ starvation.)
- e) Avoidance and treatment considerations

Module 5 Injuries and Medical Interventions

Reading Auerbach's Chapter 16-30

Additional reading:

Medicine for Mountaineering, Ed. 6th Wilkerson. Mountaineers Publishing

1. Injury Prevention

- a) Etiology of wilderness injuries
- b) Role of alcohol/gender/age/experience.
- c) Foot/blister care
- d) Activity specific injuries: altitude, UV exposure, pack weight, technical travel.
- e) Objective vs. subjective hazards

2. Analgesia

- a) Pharmacology of agents

- b) Topical analgesia
 - c) Oral and IV agents
 - d) Recommendations for field kits
3. Emergency Airway Management
- a) Assessment of airway
 - b) Improvised airway management
 - c) Airway adjuncts
 - d) Induction agents
 - e) Needle cric.
 - f) Surgical airway options
4. Wilderness Trauma Care
- a) Establishing priorities
 - b) A,B,C,D,E's.
 - c) C-spine immobilization/field clearance
 - d) Thoracic trauma
 - e) Abdominal trauma
 - f) Evacuation considerations
5. Tactical Trauma Care
- a) Scene safety/individual safety
 - b) Principles of tactical casualty combat care
 - c) Field interventions
 - d) Principles of tactile medicine
6. Wilderness Orthopedics
- a) Fractures review by mechanism (FOOSH, axial loading).
 - b) Principles of effective splints
 - c) Pelvic fractures, stabilization methods
 - d) Peripheral fracture/splint options
 - e) Joint reductions
 - f) Antibiotic options for open fractures
7. Eye, Dental, Facial Injuries
- a) Differential diagnosis for acute monocular vision loss
 - b) Differential diagnosis for acute red or painful eye
 - c) Management of mandibular dislocation
 - d) Management of acute dental pain
 - e) Management of acute dental trauma
 - f) Facial injury management
8. Chronic Diseases in the Wilderness
- a) Role of pre-departure screening, medical optimization.
 - b) Travel limitations by disease process/destination
(Hemoglobinopathies, pulmonary HTN, extremes of age, asthma, Raynaud's, etc.)
9. Mental Health in the Wilderness
- a) Pre-departure considerations
 - b) Trip leadership considerations

Module 6 Rescue and Survival

Reading Auerbach's Chapter 31-40

Additional reading: Accidents in North American Mountaineering, Golden, CO, American Alpine Club. (Published annually)

1. Wilderness EMS
 - a) Mountain search and rescue factors in U.S.
 - b) Scope of practice of U.S. EMS pre-hospital personnel
 - c) Sequence of events in backcountry rescue
 - d) The ten essentials
 - e) The essentials of personal survival

2. Search and Rescue
 - a) Search and rescue overview
 - b) Review of U.S. rescue coordinating centers
 - c) Review of the four phases of a search and rescue event: the incident cycle
 - d) Rescue considerations by location/climate: whitewater, cold water, surf zone, mountain, high altitude.

3. Technical Rescue
 - a) High angle rescue considerations
 - b) Terrain classification
 - c) Personal protective gear
 - d) Patient care and transport tools
 - e) Patient lift and lower devices

4. Litters and Carries
 - a) Fireman's carry
 - b) Websling carry
 - c) Single rescuer splint coil carry
 - d) Improvised litters
 - e) Manufactured litters
 - f) Carry manpower considerations

5. Aeromedical Transport
 - a) Types of aeromedical transport programs
 - b) Trauma care aboard emergency medical services helicopters
 - c) Aeromedical transport aircraft: technical abilities
 - d) Aeromedical transport aircraft: equipment recommendations
 - e) Establishing safe landing zones
 - f) Helicopter safety

6. Essentials of Wilderness Survival
 - a) Essentials of survival: oxygen, shelter, water
 - b) Warm weather improved shelters
 - c) Cold weather improved shelters
 - d) Potential sources of food
 - e) Potential source of safe water
 - f) Essentials of navigation
 - g) Weather considerations

7. Desert Travel and Survival
 - a) Deserts: defined and geographic distribution

- b) Priorities for survival
 - c) Water sources: found and solar still
 - d) Shelter construction
8. Jungle Travel and Survival
 - a) Trip preparation
 - b) Medical kit for jungle travel
 - c) Insect protection
 - d) Construction of mosquito netting/hammock shelter
 - e) Objective Hazards: plant, animal
 9. Whitewater Medicine
 - a) River running craft: qualities, limitations
 - b) Whitewater rating scale. additional considerations of temperature, river volume, surrounding terrain, and geographic isolation.
 - c) Whitewater fluid dynamics/consequent hazards
 - d) Entrapments: foot, boat, strainers
 - e) Swift water rescue
 10. Cave Rescue, Considerations
 - a) Geology underlying cave formation
 - b) Specific navigation considerations
 - c) Personal and cave protection
 - d) Cave rescue: water, space, and vertical hazards
 - e) Environmental considerations

Module 7 Animals, Insects, Zoonoses

Reading Auerbach's Chapters 41-55

Additional reading:

Miller ET, Marsh RH, Harris NS. **Rabies exposure: implications for wilderness travelers.** Wilderness Environ Med. 2009 Fall;20(3):290-6.

1. Arthropod-Borne Infectious Diseases.
 - a) Representative species
 - b) Chemical insect-bite prophylaxis
 - c) Personal safety considerations: location of travel, time of day, clothing and sleeping choices
2. Mosquitoes/Mosquito Borne Diseases
 - a) Primary species/ranges/factors effecting prevalence
 - b) Epidemiology and transmission
 - c) Malaria: epidemiology, endemic regions, forms, clinical presentation, prophylaxis and treatment.
 - d) Characteristics of mosquito borne viral diseases
 - e) Findings in yellow fever
 - f) Encephalitis: Japanese, Ross River, EE, West Nile, St. Louis, Murray Valley.
3. Arthropod Envenomation and Parasitism
 - a) Hymenoptera species
 - b) Ants
 - c) Clinical manifestations: local to Anaphylaxis
 - d) Treatment

- e) Lepidopterism
- f) Cutaneous Myiasis
- g) Lice
- h) Scabies

4. Tick Borne Diseases

- a) Tick species, endemic region
- b) Risk factors for disease transmission
- c) Major tick-borne diseases of U.S. clinical manifestations and treatment: Lyme, RMSF, Relapsing Fever, Ehrlichiosis, Babesiosis, Tularemia.

5. Spider Bites

- a) Clinically important spider species by geographic distribution
- b) Clinical manifestations and treatment of N. American spider bites: Black Widow and Brown Hairy Recluse.

6. Scorpion Envenomation

- a) Clinically important scorpion species by geographic distribution
- b) Physical characteristics of scorpions dangerous to humans
- c) Clinical manifestations of envenomation
- d) Antivenon, treatment considerations

7. Reptile Bites in the Americas

- a) Snake identification characteristics
- b) Crotalid vs. non-crotalid species
- c) Hematoxic vs. neurotoxic venoms
- d) Differentiating snake bite (potentially 'dry') vs. envenomation.
- e) Antivenoms – Crofab vs. Equine serums, treatment dosing, cautions.
- f) Disposition/ follow up by species classification.
- g) Gila/reptile envenomation considerations

8. Snake Bites Outside of the Americas

- a) Snake identification characteristics
- b) Distinguishing between venomous and non-venomous snakes
- c) Representative venomous species by geographic location
- d) Management algorithm for snakebite in remote locations
- e) Antivenom choices and locations

9. Wild and Domestic Animal Bites

- a) Incidence of animal bites in the U.S.
- b) Human deaths by animal attack
- c) Treatment of animal wound bites.
- d) Risk factors for infection following animal bite
- e) Empiric antibiotic considerations by species

10. Wilderness Acquired Zoonoses

- a) Anthrax: epidemiology, clinical manifestation, treatment
- b) Brucellosis : epidemiology, clinical manifestation, treatment
- c) Leptospirosis: epidemiology, clinical manifestation, treatment
- d) Tularemia: epidemiology, clinical manifestation, treatment
- e) Hanta Virus: epidemiology, clinical manifestation, treatment

11. Rabies

- a) Animal endemic reservoirs
- b) Geographic ranges by species

- c) Prophylaxis: primary and secondary
- d) Clinical manifestations/course.

Module 8 Plants

Reading Auerbach's Chapters 55-60

Additional reading:

"*The Biogeography of Jimson Weed (Datura stramonium).*"

<http://bss.sfsu.edu/holzman/courses/Spring%2005%20projects/jimsonweed.htm>

1. Seasonal and Allergic Plant Reactions
 - a) Pathophysiology of allergic responses
 - b) Local responses and treatment
 - c) Systemic/anaphylaxis and treatment
2. Plant Related Dermatitis
 - a) Poison Ivy/ Oak: plant characteristics, clinical manifestation treatment.
 - b) Poison Sumac: plant characteristics, clinical manifestation, treatment
3. Toxic Plant Ingestions
 - a) General considerations.
 - b) Signs and symptoms of plant intoxications
 - c) Anticholinergic manifestations: Deadly Nightshade, Jimson Weed
 - d) Hallucinogenic manifestations: Morning Glory, Peyote.
 - e) Cardiac Glycosides: Foxglove
 - f) Oral irritants: Philodendron, Dieffenbachia
4. Toxic Mushroom Ingestions
 - a) Mushroom gill types
 - b) Types of mushroom toxicity
 - c) Guide to mushroom identification
 - d) Amanita poisoning, treatment
 - e) Psilocybin toxin, treatment
 - f) General approaches to toxin mushroom therapy
5. Ethnobotany: Plant Derived Medical Therapeutics
 - a) History of ethnobotany
 - b) N. American medicinal plants: considerations

Module 9 Food and Water

Reading Auerbach's Chapters 61-67

Additional reading:

The Omnivore's Dilemma. Michael Pollin. The Penguin Press. 2006

1. Field Water Disinfection
 - a) Water-borne enteric pathogens
 - b) Methods of water disinfection in the field: heat, filtering, sedimentation, chemical treatment.
 - c) Disinfection: volume considerations.
2. Infectious Diarrhea from Wilderness and Foreign Travel
 - a) Giardiasis: manifestations and treatment
 - b) Travelers diarrhea: manifestations and treatment

- c) Cholera: manifestations and treatment
 - d) E. coli (enterotoxigenic): manifestations and treatment
3. Nutrition, Malnutrition, and Starvation
 - a) Role of nutrition in wilderness exploration
 - b) Energy requirements: fat, protein, carbohydrates
 - c) Acute starvation physiology
 - d) Chronic starvation physiology
 4. Hydration, Dehydration, and Hyper-hydration
 - a) Hydration status assessment
 - b) Dehydration effects on physical performance
 - c) Factors affecting fluid loss, fluid requirements
 - d) Hyperhydration: avoidance and treatment
 5. Living off the Land
 - a) Daily food and water requirements
 - b) Sources of water by environment: alpine, desert, ocean
 - c) Source of food: insect, rodent, large animal, bird/egg, fish, plant by environment.
 - d) Snares, fishing, spears
 - e) Universal plant edibility test
 6. Seafood Toxicoses/ Allergies
 - a) Representative poisonous fish and sharks
 - b) Scombroid poisoning, treatment
 - c) Tetrodotoxin poisoning, treatment
 - d) Ciguatera poisoning, treatment
 - e) Pathogens in seafood: vibrio species, parasitic diseases

Module 10 Marine Medicine

Reading Auerbach's Chapters 68-76

Additional reading:

"The Old Man and the Sea." Ernest Hemingway

See **Appendix A: "Advanced Training in Marine and Hyperbaric Medicine."**

1. Submersion Injuries
 - a) Near- and drowning classifications
 - b) Pathophysiology of submersion Injuries
 - c) Wet vs. dry, salt vs. fresh water events
 - d) Management of drowning
 - e) Hypothermia: avoidance, typical manifestations, treatment
2. Diving Medicine
 - a) Portable oxygen and indications for usage
 - b) Means of oxygen administration: NRB, BVM, NC
 - c) Types of diving equipment
 - d) Dysbarism: defined, clinical manifestations, treatment
 - e) Dysbarism: by organ: ear, lung, neurologic, vascular considerations.
 - f) Flying after diving
3. Hyperbaric Medicine
 - a) History

- b) Mechanisms and indications for hyperbaric oxygen
 - c) Types of chambers: portable, mono vs. multiplace
 - d) Contraindications
4. Injuries from Non-venomous Marine Animals
 - a) Pathogens associated with marine acquired wounds
 - b) Shark bite: species, avoidance, clinical considerations
 - c) Other species of note: Barracuda, Sea Lions, Crocodiles, Stony Corals
 5. Envenomations by Invertebrate Marine Animals
 - a) Coelenterates: morphology, venom, treatment
 - b) Box Jellyfish: clinical manifestations, antivenom
 - c) Sea Urchins and Octopuses: treatment
 - d) Algorithmic approach to marine envenomation
 6. Envenomations by Vertebrate Marine Animals
 - a) Stingray: avoidance, clinical manifestation, treatment
 - b) Scorpion Fish: avoidance, clinical manifestation, treatment
 - c) Stone Fish: avoidance, clinical manifestation, treatment
 - d) Platypus: clinical considerations
 7. Safety and Survival at Sea
 - a) Emergencies at sea
 - b) Means to control flooding
 - c) Guidelines for fighting fires at sea
 - d) Preventing collisions at sea
 - e) Storm warnings
 - f) Evacuations

Module 11 Travel, Environmental Hazards, and Disasters

Reading Auerbach's Chapters 77-80

Additional reading:

The Deadly Choices at Memorial. By Sheri Fink. (HAEMR Resident and 2010 Pulitzer Prize Winner). *New York Times Magazine*. August 27, 2009. <http://www.propublica.org/series/deadly-choices>

1. Travel Medicine
 - a) History for travel medicine risk assessment
 - b) Hazards of air travel
 - c) Immunization considerations
 - e) Endemic disease avoidance
2. Non-North American Travel and Exotic Diseases
 - a) Major viral hemorrhagic fevers: Yellow, Dengue, Lassa, Ebola and
 - f) Marburg Fevers
 - c) Major protozoan infections: Malaria, Trypanosomiasis, Leishmaniosis.
 - g) Hepatitis's
 - h) Helminthic infections: Schistosomiasis, Filariases, Ascariasis, Hookworm, Strongyloides.
3. Natural Disaster Management
 - a) Informational management systems

- b) Short-term effects of major natural disasters
 - c) Health care needs in specific natural disasters: floods, earthquake, hurricanes, volcanoes
 - d) Disaster response organizations
4. Natural and Human Made Disasters: Disaster Risk Management Issues
- a) Essentials to prevent or prepare for an emergency
 - b) Disaster mitigation strategies: earthquake, flood, hurricane, volcano, tsunami, landslide, drought, tornado.

Module 12 Equipment and Special Knowledge

Reading Auerbach's Chapters 81-97

1. Wilderness Equipment and Supplies
 - a) Guidelines for travel in developing countries
 - b) Factors in trip planning
 - c) Portable diagnostic instruments for wilderness travel
 - d) Specialize equipment for medical professionals
 - e) Sample medications for wilderness travel
2. Outdoor Clothing for Wilderness Professionals
 - a) Design properties for clothing
 - b) Dressing in layers
 - c) Special use clothing: insect repellent, fire resistant.
 - d) Climate-specific clothing: high altitude, extreme cold, wet climate
 - e) Foot gear
3. Wilderness Navigation Techniques
 - a) Map and compass skills
 - b) Celestial navigation
 - c) Latitude/longitude, coordinate systems.
 - d) GPS systems, limitations
4. Special Population Considerations: Children, Pregnant, Elderly.
 - a) Children: thermoregulation, safety.
 - b) Age-specific considerations for wilderness travel
 - c) Risk avoidance during travel
 - d) Signs and treatment of pediatric dehydration
 - e) Potential contraindications for wilderness travel during pregnancy
 - f) Definitions of elders: chronologic, pathologic, functional.
 - g) Age related biologic changes with functional consequences
5. Wilderness and Endurance Events
 - a) Medical support for mass gatherings
 - b) Adventure races
 - c) Development of a medical support plan
 - d) Legal considerations
6. Wilderness Medical Education
 - a) Principles of adult learning
 - b) Wilderness specific considerations: size, location, environment
 - c) Curriculum development

7. Wilderness Management and Preservation
 - a) Issues in environmental change: population, species diversity, habitat, global warming, human penetration into wilderness.
 - b) Historical development of the wilderness concept
 - c) Wilderness stewardship philosophy, threat management.
 - d) Wilderness management principles

II. Clinical Experience

A firm clinical grounding in the practice of emergency medicine is foremost in the skill set of an effective wilderness medicine practitioner. This is provided through the completion of an emergency medicine residency and by ongoing, active practice in a busy ED.

A critical component of post-graduate education is the opportunity to practice in a setting where more experienced practitioners are immediately available for consultation and case review.

Wilderness medicine fellows will practice no more than 16 hours/ week in the MGH ED, where at least one and as many as 5 seasoned clinicians are simultaneously involved in direct patient care (staffing requirements established by time of day). Our experience shows that this independent practice of patient care in a carefully mentored environment allows rapid further advance of young clinicians, while encouraging the independence required for effective wilderness medical care.

To develop critical experience in austere settings, our fellows are expected to spend at least three months of their year actively participating in wilderness/ developing world clinical care.

CORE CLINICAL EXPERIENCES:

Our clinical curriculum is established around three 'core' experiences. The approximate length of each experience is provided parenthetically.

- 1. Everest Base Camp Region of Nepal.** (3 months)
- 2. U.S. Army Research Institute for Environmental Medicine** (Natick, MA and Pikes Peak Summit Lab, CO). (1-2 weeks)
- 3. A Marine/Hyperbaric Clinical Experience** as described in Appendix A. (1 week)

Core Clinical Experiences are underwritten by a Continuing Medical Education Stipend.

1 Everest Base Camp Region of Nepal

The 'core' component of our wilderness clinical experience is in the Everest Base Camp region of Nepal with the Himalayan Rescue Association (HRA). Each of our first three fellows has engaged in a 3 month clinical experience with the HRA's clinic in Pheriche, Nepal. This HRA clinic was established in the 1970's and provides a critical medical resource for both local and trekking/climbing populations in the austere Khumbu Valley of Nepal. It is at the base of Mt. Everest, and so while accessible only by days of walking and in an austere environment, has a continuous stream of both western trekkers and local porters and local villagers as patients. This clinical population offers experience in a range of important conditions, from acute mountain sickness and HAPE, to blunt trauma, to infectious diarrhea, to labor and delivery. Fellows are accompanied and directly under the supervision of Board Certified physicians throughout their stay. Our fellowship has a long association with the leadership of the HRA, which has continued to offer an outstanding clinical experience for our fellows. The HRA clinic continues to be

the site of groundbreaking high altitude research and the site of productive research by our prior fellows.

The strengths of the HRA's Pheriche clinic experience include: 1) high altitude, 2) austere setting, 3) traumatic, medical, obstetric, and emergency medical cases that routinely present, 4) the continuous oversight of faculty, 5) our stable relationship with this organization over decades, and 6) my past personal clinical experience at this site which provides good insight into the quality of supervision, the richness of the patient population, and how to maximize the learning experience and minimize obstructions for the fellow. Given the extraordinary resources this site offers, we intend for this experience to continue to offer the primary site of our clinical experience in the years to come.

2 U.S. Army Research Institute for Environmental Medicine (Natick, MA and Pikes Peak Summit Lab, CO)

A second required 'core' clinical component of our fellowship takes advantage of our warm collegial relationship with the U.S. Army Research Institute for Environmental Medicine (USARIEM). Based in Natick, Mass, USARIEM is the national center for environmental medicine for the U.S. Armed Forces. We have a multi-year experience, both clinical and research, working with the USARIEM team. We have current, multi-year funding for research ongoing between our organizations. Given their immediate proximity to Boston, the fellow is offered frequent interactions with the advanced expertise of the USARIEM team on multiple protocols. Prior fellows have gained critical clinical exposure as they have assisted in the care of research subjects and research scientists during ongoing studies in Natick hypobaric chamber and Pikes Peak Labs in Colorado. Time at USARIEM is typically spent on a day to day basis as hypobaric protocols are being run (e.g. 7A-4 P on Mondays and Thursdays when subjects are being exposed to hypobaric conditions). This experience will continue to be central to our fellow's educational experience.

3 Marine/ Hyperbaric Clinical Experience

The last required 'core' clinical component is a marine and hyperbaric medicine component. This experience and expectation is fully described in Appendix A.

Additional Elective Experiences:

Additionally, prior fellows have also engaged in leadership/ field medical staff position opportunities with:

- Primal Quest – caring for racing and support staff
- Explorers' Club – caring for expedition members on international journeys.
- Gokyo Porters' Clinic (Khumbu, Nepal)
- Denali high altitude backcountry patrols (U.S. Park Service)
- National Outdoor Leadership School/ Wilderness Medicine Institute (Alaska, Wyoming, Baja, Patagonia).

On each of these other experiences, the fellow is offered advanced preparation prior to departure, a proctored field experience by staff, and a detailed post-experience debrief to allow for maximal oversight and learning.

Collegial Cross Pollination with other U.S. Wilderness Medicine Fellowships:

The fellowship directors of the four current Wilderness Medicine Fellowships (Stanford, University of Utah, University of California, San Francisco/ Fresno, and our own) are in

frequent contact. We share a common belief that our combined strengths are greater than our isolated programs and we encourage collegial interactions for all of our fellows to maximize their learning experiences.

Early collaborations include those of Stanford's fellow with our own in clinical and research opportunities in Nepal. We look forward to developing other opportunities.

We also seek to further domestic collaborations so that fellows may take advantage of local austere environments unique to other programs.

III. Longitudinal Core, Required Components:

There are three additional critical, longitudinal components that all fellows are mandated to complete:

- 1. Research Skills/Topics**
- 2. Wilderness Technical Skills**
- 3. Leadership/ Teaching Skills**

Each of these topics is critical to the fellowship year – and will remain so for the rest of a career. They are taught using seminar, field experience, and experiential education.

1. Research Skills/Topics

Required reading: *An Introduction to Medical Statistics*. 3rd Edition. J. Martin Bland, Oxford University Press, 2000.

Additional Reading: Accompanying Appendix C, "Wilderness Medicine Research Seminar."

It is expected that all Wilderness Medicine Fellows will actively pursue research as a key focus of their fellowship. The Massachusetts General Hospital Department of Emergency Medicine supports each fellow with a research stipend to help advance scholarly projects.

The goal of this component is to teach and review topics and skills required for a successful research career. Rather than a listing of individual, important skills, we teach research skills as a narrative process. While individual scientific papers are might appear as isolated objects, each is the product of a human narrative -- from first inklings of an idea to explore, to a final published work. Specific, statistical and other tools are part of the narrative.

These research skills will be taught by acquiring cognitive skills through reading of Dr. Bland's text, discussion, and through experiential education.

Topics:

1. Finding your niche/ topic in Wilderness Medicine
 - a) Establish what early interests you want to pursue.
 - b) Establishing a rough hypothesis
 - c) Pub Med/ appropriate text/ established expert review to find out what's been previously done
 - d) Refining your hypothesis
2. Research Planning
 - a) Mechanics and considerations for field-based research
 - b) Environmental exposure limitations on devices, means of gathering and storing data

- c) Site selection for enrolling subjects (pre-established cohort vs. field enrollment).
 - d) Potential means to maximize ease of enrollment (site, affiliations, inducements)
 - e) Funding considerations -- most importantly if it needed. If so, who might be approached? Institutional, government and NGO sources.
 - f) Constructing a budget, establishing time/ travel/ equipment requirements
 - g) Safe, secure storage options for field data storage, back-up options
3. Statistics
 - a) Guided by discussion and utilization of Dr. Bland's text.
 - b) Adequately powering your studies
 - c) Maximizing statistical tools to hypothesis being tested.
 - d) Analysis of data
4. IRB's Navigation
 - a) Understanding the role of IRB's
 - b) Expedited vs. full review considerations
 - c) Anticipating and avoiding problems
 - d) Writing IRB application to minimal need for revision.
 - e) How to answer concerns/ revision requests.
 - f) Organization – establishing systems to track multiple concurrent IRB applications/ renewals/ amendments
5. Measurement forms/ field devices
 - a) Matching form to data to be gathered (e.g. differenced between data forms (simple nominal vs. categorical data), Visual analogue scales vs. ultrasound images, paper vs. electronic format (iPaq)
6. Analysis of data
 - a) Matching the right statistical test to the data.
 - b) Leading statistical programs.
 - c) Statistical resources at MGH, HMS.
7. Choosing prospective journals for submission.
 - a) Review journals – match your study's form, content, breadth to journal.
8. Writing paper.
 - a) Energy of activation is overcome by simple sitting down and starting. This is the critical point at which many studies (with data fully gathered and analyzed, become still-born.)
 - b) Thoughts to manuscript construction
9. Responding to peer- reviewers
 - a) Recognizing 'good' vs. 'bad' editorial suggestions
 - b) Deciding which editorial suggestions to adopt: what's best for the work.
 - c) Employing the art of diplomacy in editorial interaction

Research Opportunities:

There are numerous research opportunities within the department as well as with faculty throughout the Massachusetts General Hospital and Harvard University.

Research Activities are underwritten by a Research Stipend.

Current, active collaborations include projects with:

- MGH Divisions of Cardiology, Pulmonary and Critical Care, and Surgery.
- Research investigators at the US Army Research Institute for Environmental Medicine (USARIEM) (Natick, MA and Pikes Peak Lab).
- Investigators with the Himalayan Rescue Association (HRA) (We have pursued a number of different research projects with the HRA over the last decade).
- Faculty of Harvard Medical School.
- Investigators with the joint MIT/Harvard Medical School venture, the Center for Integration of Medicine and Innovative Technology (CIMIT).
- WMI/NOLS on educational outcomes for wilderness medicine courses.

Our research has been supported by grant funding through the MGH, HMS, CIMIT, the U.S. Department of Defense, and the National Institutes of Health.

Regular and direct contact with the Fellowship Director allows planning and oversight of fellow's individual research projects.

Additionally, MGH is the home of the International HAPE Registry. Dr. Harris is Registry Master and Chair of the Steering Committee.

To date, faculty and fellows have published their research on a range of topics including: the first description of ultrasound to diagnose HAPE; the treatment of HAPE at high altitude; correlation of optic nerve sheath diameter with symptoms of acute mountain sickness and in cases of HAPE; efficacy trials for high altitude headache analgesia; response of the right ventricle and pulmonary vascular pressure in response to acute hypoxia; and case reports on rabid fox attack and acute arterial thrombus requiring loss of limb.

Fellows are encouraged to pursue their specific interests in developing research projects that will be rewarding in the immediate term, and that will prepare them for a career as a leader in wilderness medicine.

4. Wilderness Technical Skills.

Wilderness medicine is defined as the practice of medicine in resource limited, austere environments. Safely practicing medicine under austere conditions requires a discrete and teachable body of expertise – not limited to skills of keeping you and your patients physically comfortable in any of a range of demanding climates; the ability to safely acquire food, water, and dispose of human waste in any of a variety of biomes; and technical wilderness travel skills including navigation and safe travel in environments not limited to those involving the hazards of high altitude, high angles, moving water, and extremes of temperature.

These skills are taught through seminar and by direct field experience under direct supervision.

1. Demonstrate critical knots and when each is best\ used:
 - a) figure 8 knot
 - b) figure 8 follow through
 - c) clove-hitch
 - d) bowline
 - e) square knot
 - f) sheet-bend
 - g) truckers hitch

2. Demonstrate ability to set up safe climbing area.
 - a) risk assessment
 - b) anchor assessment
 - c) belay systems and devices
 - d) safe rope handling
 - e) top roping supervision skills
 - f) essentials of lead climbing

3. Demonstrate competence in performance and supervision of at least one area of technical outdoor skills:
 - a) ice climbing (Huntington's Ravine, Mt. Washington, Cascades NP, WA)
 - b) rock climbing (Quincy Quarry, North Conway, NH)
 - c) whitewater canoe/kayaking (Deerfield River, Allagash River, ME.)
 - d) mountaineering (Mt. Rainier, WA. Denali NP, AK. Khumbu Valley, Nepal)
 - e) mountain Biking (Blue Hills, Canyonlands, UT)
 - f) sea Kayaking (Boston Harbor Islands, Acadian NP, ME.)

5. Leadership/ Teaching Skills

Reading: *The Leadership Educator Notebook*, National Outdoor Leadership School, Edited by: John Gookin and Shari Leach. 2009 edition.

The Wilderness Educator Notebook, 10th Edition, National Outdoor Leadership School, Edited by: John Gookin. 2006.

The successful practice of wilderness medicine is advanced by the study and practice of expedition and leadership practice and theory. The practice of wilderness medicine is inevitably a team exercise under trying circumstances. The ability to effectively anticipate common expedition logistics, to appreciate different learning and leadership styles, and to organize and effect group dynamics to effect a unified end (whether in travel, search and rescue, or clinical care) are critical skills – and ones with direct application to 'front-country' medical endeavors.

This longitudinal educational experience is taught through reading, discussion, and field experiential education.

1. Recognizing Different Learning Styles
 - a) Visual, Kinesthetic, Aural, Narrative/ Associative
 - b) Educational Techniques: Lecture, Problem-Based Learning, Case-Based Learning, Seminar, Small Groups, Field Experience

2. Teaching in the Field
 - a) Visual presentation options
 - b) Key points of ideal 'classroom' selection
 - c) When to teach: weather, time of day, goals for days travel, topography
 - d) Best use of 'teachable moments on the trail/river

3. Leadership Skills
 - a) Pre-treat Planning
 - b) Group Dynamics
 - c) Setting Realistic Personal and Group Goals
 - d) Expedition Behavior
 - e) Lessons in Effective Feedback
 - f) Leadership Styles

These skills are assessed in application: with HAEMR residents and with NOLS/WMI students by Division of WM staff. Constructive, timely feedback is given.

Fellows' Teaching Opportunities:

Classroom-based education:

Fellows have regular teaching responsibilities with the Harvard Affiliated Emergency Medicine residents and Harvard Medical School students at MGH.

Field-based Education:

Fellows are provided opportunity for teaching time in the field with the Wilderness Medicine Institute of the National Outdoor Leadership School (WMI/NOLS). Dr. Harris serves as Medical Director, Curriculum Writer, and Supervising and Field Faculty for this month-long, senior medical student course (Medicine in the Wild) taught with NOLS/WMI in the Gila Wilderness, NM. Additional opportunities for leadership/ teaching with NOLS/WMI for physician level CME are currently being developed (Wind River Range Expedition for Physicians).

Specific Goals and Objectives for Fellow:

The MGH Wilderness Medicine Fellowship is a one year program designed to give graduates of emergency medicine residency programs the skills and knowledge to become leaders in the field of wilderness medicine. The goals of our fellowship program include:

- 1) Providing a one year clinical and wilderness experience, at the completion of which, fellowship graduates should be prepared to lead or provide expert wilderness medical care anywhere on the globe.
- 2) Pursuing intellectually-rigorous research to advance the state of knowledge in wilderness medicine and publish these results.
- 3) Providing opportunity for extended field experience in the practice of wilderness medicine.
- 4) Providing experience teaching wilderness medicine to students, residents, and staff – both in the classroom and in wilderness settings.
- 5) Providing opportunity for the fellow to learn/ develop advanced outdoor technical skills (whether ice/rock/alpine climbing, whitewater or sea boating, etc).

6) Providing access to medical experiences in the developing world (remembering that wilderness medicine is defined by the practice of medicine in resource-limited environments – not exclusively by distance from human population centers).

7) Encouraging exploration of environmental policy issues as they impact human health and well-being.

8) Providing access to the breadth of Harvard University with ongoing collaborations with faculty at the Medical School and School of Public Health.

9) Providing an ongoing, clinical emergency medicine experience in a Level I trauma center in a busy urban ED.

Wilderness Medicine Fellow's Weekly Schedule

Our fellows will be expected to work the same days/ evenings/ nights/ weekends that other MGH fellows and attending staff do.

For the fellow, this will only be 16 hours/ week – so two separate 8 hour shifts. Beyond this, their schedule will include:

- 2 hours/week for teaching /discussion of assigned reading,
- 10-15 hours week for research,
- 4 hours for reading,
- 3 hours for administrative tasks,
- 1-2 hours week teaching of residents and medical students,
- 1 hour meeting with fellowship staff.

In total, approximately 36-42 hours/week for purely fellowship related activities.

While the schedule of emergency physicians is typically varied, a potential representative schedule is below:

Monday:

9:00 -17:00, clinical shift in Fast Track, MGH ED

Tuesday:

8:00-10:00am, administration.

10:00am-noon, didactics with fellowship director, fellowship staff.

Noon-16:00, MGH Emergency Medicine Rounds.

Wednesday:

8:00-9:00am, resident teaching (MGH)

9:00-16:00, research (e.g. IRB submission, data analysis).

Thursday:

7:00-16:00, research (e.g. site visit to USARIEM Hypobaric Chamber).

Friday:

9:00am-noon, reading

15:00-23:00. clinical shift Urgent, MGH ED

Appendix A: “Advanced Training in Marine and Hyperbaric Medicine.”

Our fellows are expected to develop expertise in the critical components of marine medicine. We accomplish this by a combination of reading, formal didactics, clinical experience with marine and hyperbaric cases, and offer exposure to marine research topics.

Our fellow’s clinical experience is grounded in the long-standing relationship between the MGH ED and the MEEI’s Knight Hyperbaric facility. The Knight Hyperbaric facility is staffed in part by MGH Emergency Medicine faculty. Our wilderness fellows have first hand access to following cases treated in the chambers by working with fellowship faculty on call.

Additionally, the fellowship offers advanced hyperbaric training through National Baromedical Services, the largest training course for introductory and advanced training in baromedicine in the U.S. This five day course is the leading source of advanced training in medical hyperbarics, and is the same course that MEEI/ MGH staff members undergo to further their expertise in hyperbaric treatment. The cost of the course is covered by the fellowship. This training prepares the fellow to act as a local resource for marine and hyperbaric medicine topics in the future.

During this five day experience, entitled, ***Primary Hyperbaric Training***, our fellows cover the following topics:

1. Physical Aspects of Hyperbaric Medicine

The clinical utilization of alterations in atmospheric pressure dictate that the practitioner comprehend both the beneficial and potentially hazardous aspects of this esoteric environment. Applicable gas laws and their role in hyperbaric medicine will be reviewed.

2. Mechanisms of Action

Under increased atmosphere pressure, oxygen becomes a potent and dose dependent drug. Six beneficial effects have been identified: hyperoxygenation, vasoconstriction, superoxide radical formation, pressure/volume related effects, neovascularization and antagonism of leukocyte induced reperfusion injury. The scientific elucidation of these mechanisms and their clinical relevance are discussed.

3. Patient Care

Special emphasis will be placed upon the preparation of the patient for hyperbaric oxygen therapy. The typical emergent referral involves a patient who is intubated, ventilator dependent, with peripheral and central vascular access lines and the possibility of a chest tube. Each of these aspects, as they relate to relative patient isolation and alterations in atmospheric pressure, will be discussed and practiced. Risk factors for hyperbaric oxygen exposure will be clarified and the management of patient complications reviewed in detail.

4. Oxygen Toxicity

As a gaseous drug, large doses of oxygen can produce undesirable side effects and drug interactions. The central nervous system and lungs are two most commonly effected organs and their response to hyperbaric oxygen will be reviewed in depth. Special emphasis will be placed on the recognition and management of CNS oxygen toxicity.

5. Monoplace Chamber Operations

Through a cohesive series of clinical training sessions, the prospective hyperbaric team member will learn and participate in all aspects of the monoplace hyperbaric chamber delivery system. Standard operational protocols will be augmented with ancillary equipment demonstrations and a detailed review of emergency procedures.

6. Contraindications and Side Effects

Pre-exposure evaluation of risk factors centers on the prevention of pulmonary barotrauma of ascent and the development of a central nervous system oxygen intolerance secondary to high inspired oxygen pressures. The risk-benefit ratio will be discussed, and in the context of the full range of patient states.

7. Non-pulmonary Barotrauma

Boyle's law dictates that the volume of a gas is inversely proportional to the pressure exerted upon it. Specifically, the clinical ramifications of this simple principle as it relates to gas bearing anatomy will be discussed. The effects of pressure changes in the middle ear will be examined in detail, and the technical considerations of needle myringotomy will be detailed.

8. Carbon Monoxide Poisoning/Smoke Inhalation - *cyanide poisoning*

Carbon monoxide is the most common cause of poisoning in the U.S. In its subtle form the diagnosis is easily missed. A new appreciation for the phenomenon of clinical relapse following conventional oxygen therapy and the potential for long term sequelae has reshaped our understanding of this toxic gas. Current concepts in the pathophysiology of the disease are explored and will include the role of hyperbaric oxygen therapy in pregnancy.

9. Decompression Sickness

This occupational disease of divers, aviators and tunnel workers is no longer limited in presentation to coastal regions and military institutions. Decompression sickness can result from exposure to any body of water deeper than 30 feet. With more divers flying to and from their dive sites, the potential for illness must be considered, regardless of geographic location. Differential diagnosis, on-site management, evacuation protocols and definitive therapy will be discussed, as will the capabilities of the monoplace chamber.

10. Cerebral Arterial Gas Embolism

A major life-threatening event, cerebral arterial gas embolization can occur during decompression (in divers and aviators), traumatically in penetrating chest injuries and, most commonly, in the clinical setting secondary to invasive diagnostic, monitoring, or therapeutic procedures. Presentation, differential diagnosis and management guidelines will be reviewed.

11. Crush Injuries/Compartment Syndrome - *other acute ischemias*

In an earlier report, it was found that when hyperbaric oxygen therapy was used to arrest the progression of a skeletal compartment syndrome, the cost of management was one-fourth that of surgically treated compartment syndromes. While not proposed in severe cases, the use of HBO in compartment syndrome in selected cases is based on its ability to down-regulate leukocyte receptor sites, decrease tissue edema, hyperoxygenate tissue and overcome diffusion barriers. Evidence for its role in the management of crush injuries is reviewed in detail.

12. Gas Gangrene - *necrotizing soft tissue infections*

(clostridial and nonclostridial)

Anaerobic infections are among the most challenging infectious disease problems. Optimum management in many instances mandates a combined therapeutic regimen using antibiotics and surgery in combination with hyperbaric oxygen. There is a growing body of evidence to indicate that HBO provides a number of benefits, which include detoxification of the patient, enhanced white cell activity, a synergistic enhancement of selected antibiotics, and improved wound healing.

13. Acute Thermal Burns

The therapy of burns is directed at minimizing edema, preserving marginally viable tissue, enhancing host defenses and promoting wound closure. Adjunctive hyperbaric oxygen can attack all of these problems directly through a combination of mechanisms. Basic research, controlled clinical studies and cost impact will be reviewed.

14. Radiation Tissue Damage

It was the consensus of the 1990 National Cancer Institute Conference on Oral Complications of Cancer Therapies that HBO is a standard of care, in conjunction with surgery as indicated, for osteoradionecrosis of the mandible. Further, HBO was recommended in a prophylactic capacity prior to surgical procedures within the irradiated field, in high risk patients. Evidence of a benefit of HBO in soft tissue radiation injury will be included during this presentation.

15. Case Presentations

Interesting clinical problems and case illustrations will be presented. Cases have been selected which will emphasize key management principles.

Field Marine Experiences --

Prior fellows have taken advantage of excellent diving medicine courses and dive training through the Undersea and Hyperbaric Medicine Society and the Wilderness Medicine Society. These courses offer professional training in SCUBA techniques and marine environmental awareness. They cover topics from diving protocols and safety, to marine envenomations, marine trauma, hyperbaric medicine, and unique marine infectious disease considerations.

Additionally, through our decade's long relationship with the National Outdoor Leadership School and Wilderness Medical Institute, we offer access to the wide range of their marine and marine medicine courses: spanning from the icy waters of Prince William Sound, Alaska to the tropical marine environments of the western coast of Baja, Mexico. Additional experiences in Patagonia are also offered.

We have well-established contacts with the U.S. Navy's Seal Training Team (Hawaii) and marine scientific research opportunities through Hawaii Pacific University's Dr. Brenda Jenssen. Lastly, we continue to develop our contacts and collaborative relationships with the MIT/ Woods Hole teams, and would encourage our fellows to take advantage of this rich resource in our immediate locale.

Appendix B: “Wilderness, Global Health, Good Books, and Physicians.”

Wilderness, Global Health, Good Books, and Physicians
N. Stuart Harris MFA MD FACEP
Chief, Division of Wilderness Medicine
Dept of Emergency Medicine, Massachusetts General Hospital

Welcome to the course. Writing at 4:11 AM on a bizarrely quiet overnight shift in Boston, I look forward to our meeting in a warmer, less fluorescently-lit April – some three weeks after you’ve headed into the Gila wilderness.

Where now, you are (I’d like to think) clean, individual medical students scattered across N. America – and suddenly wondering what there is to learn about “Wilderness, Global Health, Good Books, and Physicians” -- when we meet in April, none of this will be true. Instead, you’ll be a well-acquainted team, and have practical medical knowledge of approaches to wilderness emergencies readily in mind. You will no longer be clean -- but it is my hope, that you will have some growing sense of the role of the physician in wilderness and global health.

The focus of your course will be learning wilderness medicine. The majority of this will be taught in the field, with hands on scenarios.

A basic and critical component will start before you head into the wilderness and will consist of reading a book of your choosing on wilderness ethics/ history/ literature. As a basic expectation of the course, I expect you to become familiar with a range of literature that examines mankind and our environmental. (The same way a 20th C lit course student would be expected to be familiar with the basics of Faulkner, Hemingway, F. Scott Fitz, etc).

I intend this project:

- 1) To expose the members of the course to the wide range of literature that investigates mankind’s relationship with the natural world.
- 2) To help facilitate a conversation about the role and responsibility of the modern physician and organized medicine in respect to ‘environmental’ issues.
- 3) To engender a sense of awareness about the important role that practicing physicians can play in advocating for local and global environmental issues.

This process starts with your reading this (exceedingly long) letter. It will be ongoing during your time in the field into April. Through it, I hope you will discover some sense of the role and reach of wilderness and global health as it impacts your chosen career.

I intend it to be facilitated by senior EM resident, Dr. Goldflam, and your NOLS/WMI instructors (The Esteemed Mr. John Hovey Esq.), and later myself -- but to be self-guided and self-motivated if it is to be worth a damn. For most med students, this is an aberration – we become very good at devouring and regurgitating vast amounts of data for our regular tests (gross, histo, surg and IM clerkships, Steps I, II, III, and then Speciality Board Certification, 10 y. recert, etc) – but only rarely as I see it, are we given the opportunity to stand up from a desk, look around, and to come to some intellectual and spiritual end by our own lights. From what I’ve heard from last year’s course members, if this course doesn’t accomplish some nurturing of an independent and ongoing intellectual adventure on this topic, I’ll be surprised.

Any NOLS course can have a life-transforming influence – that may not be your intent in signing up, and it might not seem like it on the course itself, but more often than not, it

turns out to be true. Like all NOLS courses, *Medicine in the Wild* will demand a great deal of your flexibility, good humor, and physical endurance – but in addition to the practical medical knowledge this course imparts, I intend this process to offer a social/spiritual/ intellectual challenge I frankly see as the more long lasting and potentially transformative influence.

You have chosen a profession where at some point soon, you'll be working as a resident in a tertiary care center ICU, surrounded by patients on ventilators and pressors – and the wilderness will seem a very long way away. Your med school debt will still be compounding. In this setting, it would seem the import of wilderness and global health awareness would be very limited. I hope to extend to you some sense of why for physicians, especially in this setting, some larger sense of the physicians' mission is enriched by having an appreciation of the effect that wilderness and global health has on each of us as individuals. Books and a month in the wilderness are the tools to help achieve this goal.

'So who the heck is this guy?' you're likely asking. I'll leave that to Dr. Goldflam to hint at and for you to decide when 'the clean guy' walks in to meet you in the Gila Wilderness. In brief, though, I'll be approaching this project from the point of view of an academic emergency physician, a former NOLS student, a former NOLS instructor, a graduate of the Iowa Writers' Workshop, father, and long-time whitewater boater/ sea kayaker/mountaineer.

It is your responsibility to:

1. Choose any one of the texts noted below – (or any text you can convince me to approve PRE-course).
2. Closely read the text PRIOR TO ARRIVAL IN TUCSON.
3. Either PRIOR TO (by email) or on the FIRST DAY OF THE COURSE (as you show up in Tucson) hand in to Mr. John Hovey Esq, a two page (400 word) overview in which you tell me what you found most interesting about your book. I'll read them. In these, you can investigate the author's thesis, the methods they've used to establish their points or articulating any questions or issues the text has raised in your mind to date. Whatever you think is interesting in it, is what I'm interested in hearing from you. After this first day, until a couple of weeks into the course, you are encouraged to pack your book in with the re-ration supplies. This way, you need not carry it until you need it in the second half of the course (before #4 below). For the next few weeks, pay attention to the wilderness around you. A number of prior students have said, "I had no idea what this book was about, until I had the chance to live outside for two weeks, and then it made perfect sense." (This especially so from the Gary Snyder readings).
4. On the final day in the field, you will be given 10 minutes to share what you found most compelling in your book with your course mates and me. A brief summary can be great, as can reading quotations from your text that you found funny/interesting/thought-provoking -- or that you vehemently disagree with. You should try to place the book in some context (vis-à-vis place/human history/natural history/geography/politics/etc) or describe how it might relate to current global/environmental health issues. Adding a fourth to Jefferson's three truths, that there will be active group participation is self evident.
5. As you travel through the Gila, enjoy the dirt, sky, and your colleagues. As you get a chance, consider with your course mates what role MD's should play in advocating for local and global environmental health issues.

Reading List: (on a first come basis)

Sand County Almanac – Aldo Leopold – A central work in the founding of environmental awareness and studies. Beautiful, lucid, fun to read prose.

Silent Spring – Rachael Carson – well-written, seminal book that in many ways ignited the modern environmental movement. Not a good read if you love DDT or hate bald eagles.

NOLS Wilderness Ethics: Valuing and Managing Wild Places – A broad survey, with lots of good idea/good teaching points/good readings. (I get no cut in suggesting this).

The Big Necessary – Rose George – An interesting examination of how western countries deal with – and don't deal with -- their poop. After reading this, you'll begin to wonder why we chose to sully the 95% of sewage that is minimally-dirty 'grey water' with the 5% of what Rose nicely calls 'shit.' This is a good question. A bit British for my taste, but I'm sure she's working to overcome this. By any other name, I'm sure she'd smell as sweet . . .

Omnivore's Dilemma – Michael Pollan – A fascinating, well-written investigation of three potential meals, roughly broken down into "industrial food, organic or alternative food, and food we forage ourselves." For most of us, it is an eye-opening look at how ubiquitous 'industrial' food production has become – which isn't romantic, and more importantly, doesn't lead to good public policy, good health policy, or good food.

Desert Solitaire – Edward Abbey - For those not familiar with him, Abbey is a funny, somewhat prickly iconoclast, who is generally either loved or hated. This is his story of a couple of seasons as a backcountry ranger in the undeveloped Arches National Park in the early 60's.

The Monkey Wrench Gang – Edward Abbey – See above. Some would now label him an 'eco-terrorist' (if a funny, articulate, and rarely sober one) after reading about his adventures in the name of wilderness preservation.

Encounters with the Archdruid – John McPhee -- McPhee is one of the leading essayist/nonfiction writers of the last 40 years. This book describes three trips in backcountry settings – each one featuring former Sierra Club director, and then founder of Friend of the Earth, David Brower – but each with three different 'opponents' (the developers of mines, resorts and dams) along on the backcountry trip.

Cadillac Desert – Marc Reisner – A great narrative on the battle between individuals and cities to control the single most important natural resource that defines where and how people live in the Western US – water. Be forewarned, LA and Las Vegas take a bit of a beating.

Let the Mountains Talk, Let the Rivers Run – David Bower – See Brower's hx above. Essays.

The Practice of the Wild: Essays. Gary Snyder. Snyder was present at the founding of the 'Beat' poetry movement, and has spent his life as a poet, translator, environmental scholar and intellectual. His prose is lucid, extends to include science and Shamanism, Native American/Eastern/Western philosophy. A better choice for those intellectually

free-wheeling enough to strike off towards territories a bit removed from the standard scientific text.

A Place in Space: Ethics, Aesthetics, and Watersheds. (essays) Gary Snyder – Again, lucid, well-written, but intellectually vigorous essays. A personal recommendation.

For those of more of a fiction/poetry bent – I'd encourage any of a huge range of great books that address the interplay between character and environment. Potential choices:

Moby Dick. Melville -- One of those novels that everyone knows, but that we could all re-read and get something useful from it. I had an entire semester class on this novel alone in graduate school. Nominally the tale of Ishmael on this whaling ship, the *Pequod*, it remains a central text on the place of the individual within the environment.

The Adventures of Huckleberry Finn. Twain – We've all read it – and as will gain from an adult re-reading.

Mountains and Rivers Without End and Danger on Peaks (Poems) Gary Snyder – Snyder's poetry might be compared with Frost's. It is deceptively simple appearing, tending to use natural imagery and metaphor, and is both memorable and powerful for this very reason.

"The Bear Hunt" from Go Down Moses. Faulkner – this is a novella, within the collection of short stories that is GDM. It tells the story of a young man's hunt for a bear, and the changes to people and land over years that occur in this portion of Mississippi in the early 20th C.

Blood Meridian or The Road – Cormac McCarthy – Be forewarned, McCarthy is hugely violent – but his prose is as magnificent as that of any living writer today. If he doesn't win the Nobel, I'll be disappointed. Blood Meridian is set in the 19th C desert Southwest (not unlike where you'll be going shortly), and follows 'the kid' throughout this landscape. The Road is his latest, and is the story of a father and son's journey in a post-apocalyptic world.

Importantly, books are chosen on a first come basis, one per student. All are readily available (many in good quality, used editions from Amazon for \$5-15. You'll be carrying the book for 20+ days on your back. I'd make it a point NOT to get a hardback.

I'll follow this with a quick detailing of a research project overview that we'll pursue in seminar form under the tall trees.

Be in touch by email quickly to establish choices. And please be in touch with any questions.

I look forward to meeting you in the desert.
Stuart

Appendix C: “Wilderness Medicine Research Seminar.”

How to Do Wilderness (or other) Medical Research.

N. Stuart Harris MFA MD FACEP

Chief, Division of Wilderness Medicine

Dept of Emergency Medicine, Massachusetts General Hospital

I've been repeatedly asked by students on previous courses to talk about how to do research – and especially, how to do Wilderness Medicine research.

As a means of helping you to achieve this end, I've attached a paper we published a couple of years back. I ask you to read it. I intend this only as a means of helping each of you to consider how you might successfully pursue research – both as residents and in your staff careers to follow. I suggest this only as the way to do things, but more as a template for discussing how a very simple research project progresses from idea (in this case, while standing in line for coffee) to published work. Whatever research experience you may have, or might be interested in pursuing, this would be a great forum to help yourselves and others.

Nearly universal steps we will talk about include:

- Investigating early interests – what do you find yourself doing in your free time?
- Generating a rough hypothesis
- Getting to know the field: Search of Pub Med, appropriate texts to find out what's been previously done.
- Collaborators – who's smart, enthusiastic, is willing to help, and has time?
- Refine hypothesis.
- Consider funding – most importantly, is it even needed? If so, who might be approached for funding? Writing up a budget, figuring time/ travel/ equipment.
- Logistics: who needs to do what, when, and where?
- IRB's – they don't exist just to cause pain – though this is usually 95% of their product.
- Data Collection: forms, devices, ease and security of storage.
- Field Time!
- Gathering data.
- Pursuing subjects: Is it unethical to dig pits to trap prospective subjects??
- Analysis of data: finding a smart, PhD in statistics.
- Choosing prospective journals for submission.
- Writing paper.
- Responding to peer- reviewers – the art of diplomacy.
- Work is published! Start process again.

Read our paper, and tuck it into a zip lock for the field. Again, if you've published anything, please forward to me so I can incorporate it as well. Unlike your book, this should come with you in the field, and should be re-read in the days before I show up to meet you after the second re-ration, and it will help us structure a 2 hour seminar under the tall, quiet conifers above the Gila Cliff Dwellings. Any research experiences you can bring to our discussion will be much appreciated.