# Edinburgh Altitude Research Expedition 2008 Expedition Report

Edinburgh Wilderness Medicine Society, University of Edinburgh, UK

*Expedition members approach the North Ridge of Friendship Peak (5289m)*

## Summary


**Name of expedition:** Edinburgh Altitude Research Expedition 2008
**Location:** Himachal Pradesh and Zanskar, India
**Date:** 8 June 2008 – 4 July 2008
**Expedition leaders:** David Hall (davidhall@doctors.org.uk)
Richard Benson (r.p.benson@sms.ed.ac.uk)
**Contact Address:** David Hall, Flat 3F2, 14 Thirlestane Road, Marchmont, Edinburgh EH9 1AN.


## Objectives

1. To climb the Shingo-La and Phitse La passes, thereby completing a remote and high-altitude (>5000m) traverse of an underexplored region of the Zanskar Himalaya.
2. To carry out publishable medical and physiological research into cognitive effects of high altitude.
3. To successfully ascend Friendship Peak (5289m)

## Disclaimer

## Contents

## Introduction

The Edinburgh Altitude Research Expedition arose from plans by members of the University of Edinburgh Wilderness Medicine Society to pursue their interest in high altitude medicine by conducting a research expedition to one of the Greater Ranges. Originally planned with Lahore Adventure Society as a joint expedition to the Pakistani Karakoram, this plan was abandoned due to continued political instability there, and the high mountains of the Indian Western Himalaya were chosen as a natural replacement. A route was planned that offered a physical challenge over and above the mental gymnastics required to devise a research protocol rigorous enough to slip past a journal referee, yet simple enough to perform in thick gloves on a wind-battered ridge whilst suffering from the mind-dulling effects of altitude. Ascending two high passes in the remotest valleys of Zanskar, followed by a classic Himalayan climb on Friendship Peak in Himachal Pradesh seemed to offer the ideal solution. The following report describes the successful fruits of over 18 months of planning, which resulted in a successful and memorable research trip to 'the roof of the world'.

David Hall
Joint Expedition Leader

## Location

*The location of the expedition was Himachal Pradesh State and Ladakh (in Jammu and Kashmir State) of North-West India.*

## Expedition Members

*Expedition members in the Zanskar Valley, following successful ascent of Shingo La*

| | |
|---|---|
| David Hall | **UK joint expedition leader**<br>David Hall is a final year medical student, Pilot Officer in the Royal Air Force and joint president of Edinburgh University Wilderness Medicine Society. He has experience of trekking in the Karakoram (Rupal Valley/Nanga Parbat), Bolivian Andes and the High Atlas. |
| Richard Benson | **UK joint expedition leader, logistics**<br>Richard Benson is a final year medical student and co-president of Edinburgh University Wilderness Medicine Society. Richard has lead many walks throughout Great Britain as well as trekked in the Alps, the Pyrenees and the High Atlas. |
| Maddy Whitehouse | **Provisions**<br>Madeleine Whitehouse is a final year Biology student. She is an active member of St. John Ambulance and has been on a previous expedition to Chile as well as numerous treks in the Alps, the Pyrenees and the High Atlas. |
| Nikki van Gemeren | **Research Officer**<br>Nikki is a final year medical student who has trekked in the Pakistani Karakoram (Rupal Valley/Nanga Parbat), Scotland (Cairngorms) and the Pyrenees. She is enjoying her role as Research Coordinator for the expedition. Her previous research experience includes two projects at the Centre for Cardiovascular Science, University of Edinburgh, one of which was a finalist at the National Science, Engineering and Technology awards. |
| Nicky Salmon | **Entertainments Officer**<br>Nicky Salmon is a 3rd year medical student and committee member of Edinburgh University Wilderness Medicine Society. She has experience of trekking in Nepal. |

| | |
|---|---|
| Robert Young | **Safety Officer**<br>With extensive climbing experience, 2nd year medical student Rob is the expedition's safety officer. |
| David Veitch | David Veitch is a final year medical student with a BSc in immunology. He has been involved in leprosy research in Anandaban Hospital, Nepal and has experience of trekking in the Nepal Himalayas, northern Vietnam and the French Alps. |
| Kirsty Steggles | Kirsty Steggles is a final year medical student with experience of trekking in the Bolivian Andes and the Atlas Mountains. She is an experienced traveler and has explored China, Mongolia and the Andean countries. |
| Richie Dargie | Currently in 3rd year of medical school, Richie has extensive experience mountaineering in the Alps and Scottish Highlands |

**Background to Research Objectives:**

Both high altitude and rapid ascent to altitudes over 3000m are associated with three major diseases: acute mountain sickness (AMS), high altitude pulmonary oedema (HAPE) and high-altitude cerebral oedema (HACE). The latter two are of rapid onset, frequently fatal, and responsible for the deaths of many trekkers, skiers and mountaineers every year. Due to the difficulties of conducting scientifically controlled studies in extreme environments, knowledge about these conditions is limited. The process that leads to disease (and frequently death) is currently unknown and moreover, there are striking individual differences in susceptibility to becoming ill at altitude.

Neuropsychological functioning deteriorates at high (>3500m) and extremely high (>7500m) altitudes, as manifested by decreased psychomotor performance, perception, learning, memory, language and cognitive flexibility (Virués-Ortega *et al.*, 2004). This was first noted anecdotally as early as 1890 (Janssen, 1890), and was the subject of frequent complaints during Golden Age of Himalayan mountaineering (Herzog, 1952; Shipton, 1943). The first serious study into the cognitive and perceptive alterations at altitude was conducted by McFarland, who investigated changes in psychomotor coordination and memory (McFarland, 1937). Since then, attempts have been made to establish more precisely the pattern of neuropsychological impairment associated with altitude and to delineate its causation (Garrido, 1995; Regard, 1991).

Altitude-associated impairment of cognitive function has received particular attention. Reaction times (RT) provide a useful and well-established measure of cognitive functioning (Deary *et al.*, 2001). Moreover, their measurement is non-invasive and relatively simple, and thus easy to perform on high-altitude expeditions. Increases in RT have been found both in laboratory-simulated high altitude (Bolmont, 2001) and on real expeditions (Kramer, 1993; Mackintosh *et al.*, 1988). Although acute mountain sickness (AMS) triggers a greater increase in RT compared to sea-level baselines (Mackintosh *et al.*, 1988), RT also increases in subjects without AMS. Furthermore, whilst dramatic decreases in RT occur following prolonged stays above 6000m (West, 1984), it has been established that significant and detectable changes occur above 2500m (Fowler, 1987). Although little is known regarding the middle- to long-term effects of high altitude exposure on cognitive function, there is limited evidence to suggest that persistent impairment occurs in some subjects (Cavaletti *et al.*, 1990), even following a single ascent (Cavaletti *et al.*, 1993).

The mechanisms driving these RT increases remain at least partly unclear. In studies measuring both auditory and visual event-related potentials at simulated high-altitude, RT increases correlate with increases in P300 latency (Fowler, 1995; Wesensten, 1993). This suggests that a slowing in the identification of stimuli is responsible for the increased RT observed. Furthermore, in a hypobaric simulation of increasing altitude, increases in both RT and P300 were linearly related to decreasing oxygen saturation (Fowler, 1995). Finally, more complex, response-related processing abnormalities underlying reaction time increases have also been described, such as reduced contingent negative variation (Takagi, 1999).

RT tasks measure the fundamental processing speed of the central nervous system. Whereas the vast majority of studies focus on mean RT, intra-individual variability (standard deviation) in RT may often be a superior measure of RT central tendency and is of interest in its own right. Differences in mean RT are useful principally at small levels of intra-individual variability, but as variability increases, it indicates systematic rather than random errors which may be masked by quoting mean alone (Jensen, 1992). Although highly correlated with mean RT, variability may reflect different sources of variance (Jensen, 1992) and is a valuable indicator of cognitive function that has predictive value beyond that of mean RT (Hultsch *et al.*, 2002; MacDonald *et al.*, 2006). Importantly, increased RT variability marks the decline in cognitive function seen in normal ageing (Der *et al.*, 2006) neurodegenerative conditions (Burton *et al.*, 2006) and traumatic brain injury (MacDonald *et al.*, 2006).

Although the increase in RT with altitude is established, there are to our knowledge no studies which investigate changes in intra-individual variability of RT during ascent to high altitude and during subsequent descent. The Edinburgh Altitude Research Expedition 2008 Expedition offers an ideal opportunity to explore this area and further the understanding of altitude-induced cognitive impairment.

**There are no studies which investigate changes in intra-individual variability of RT during ascent to high altitude and during subsequent descent. We will therefore conduct a longitudinal cohort study to evaluate the effects of altitude on choice reaction time mean and intra-individual variability in healthy lowlanders when they ascend on foot to 5100m.**

## Research Participants and Methodology

10 healthy participants (6 male, 4 female) from thne University of Edinburgh were recruited to the study. Participants were all members of the Edinburgh Altitude Research Expedition 2008, and between 19 and 24 years old.

Reaction time (RT) was measured using a specially-designed, previously-validated portable reaction time box, which calculates the mean and standard deviation of choice reaction times measured in each participants over a range of difference altitudes (from sea-level to 5560m). Data were correlated with dependent variables such as core body temperature, environmental temperature, oxygen saturation.

*Measuring blood pressure at 4500m in the Zanskar Valley, and using the reaction time box at 5560m on Phitse La*

## Research Ethics

All experiments are non-invasive, use well-validated techniques and do not require participants to take medication. Full ethical approval for medical research was sought from the University of Edinburgh Undergraduate Ethics Committee and the study adhered to the tenants of the Declaration of Helsinki. Written, informed consent was also obtained from each participant prior to the expedition.

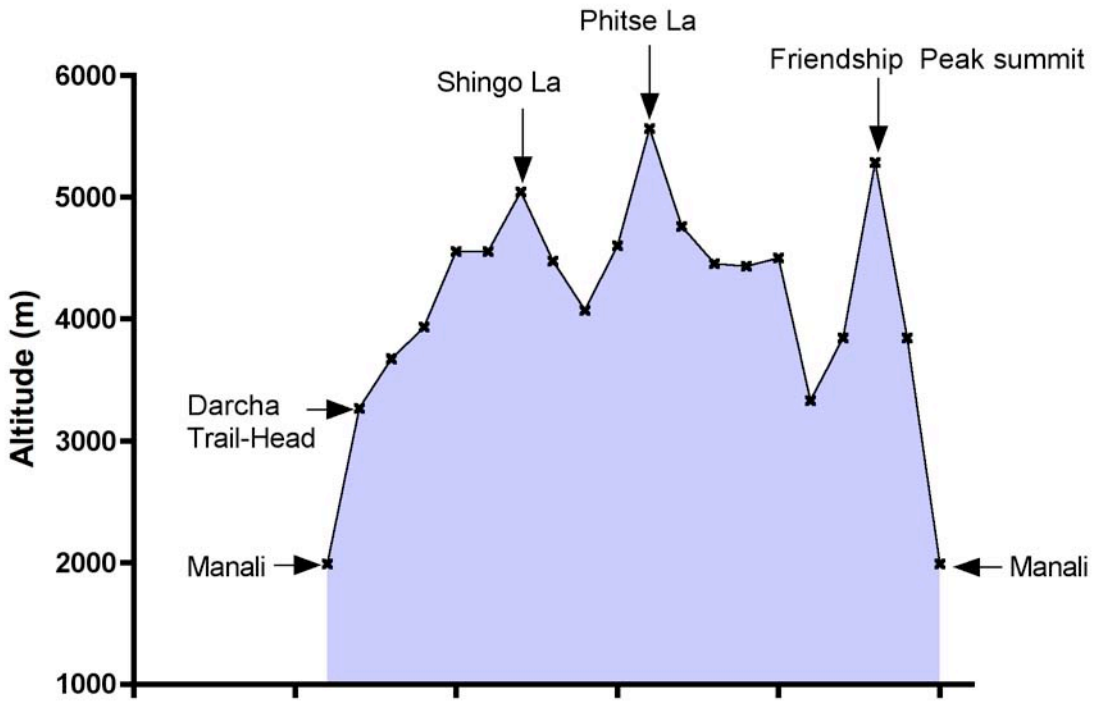
## Dissemination of Results

Data obtained are currently in the process of being analysed for publication in an academic journal. A copy of this paper will be made available to sponsors, and to other interested parties on request. Results have also been submitted to the Royal College of Physicians of Edinburgh High Altitude Research Symposium in November 2008.

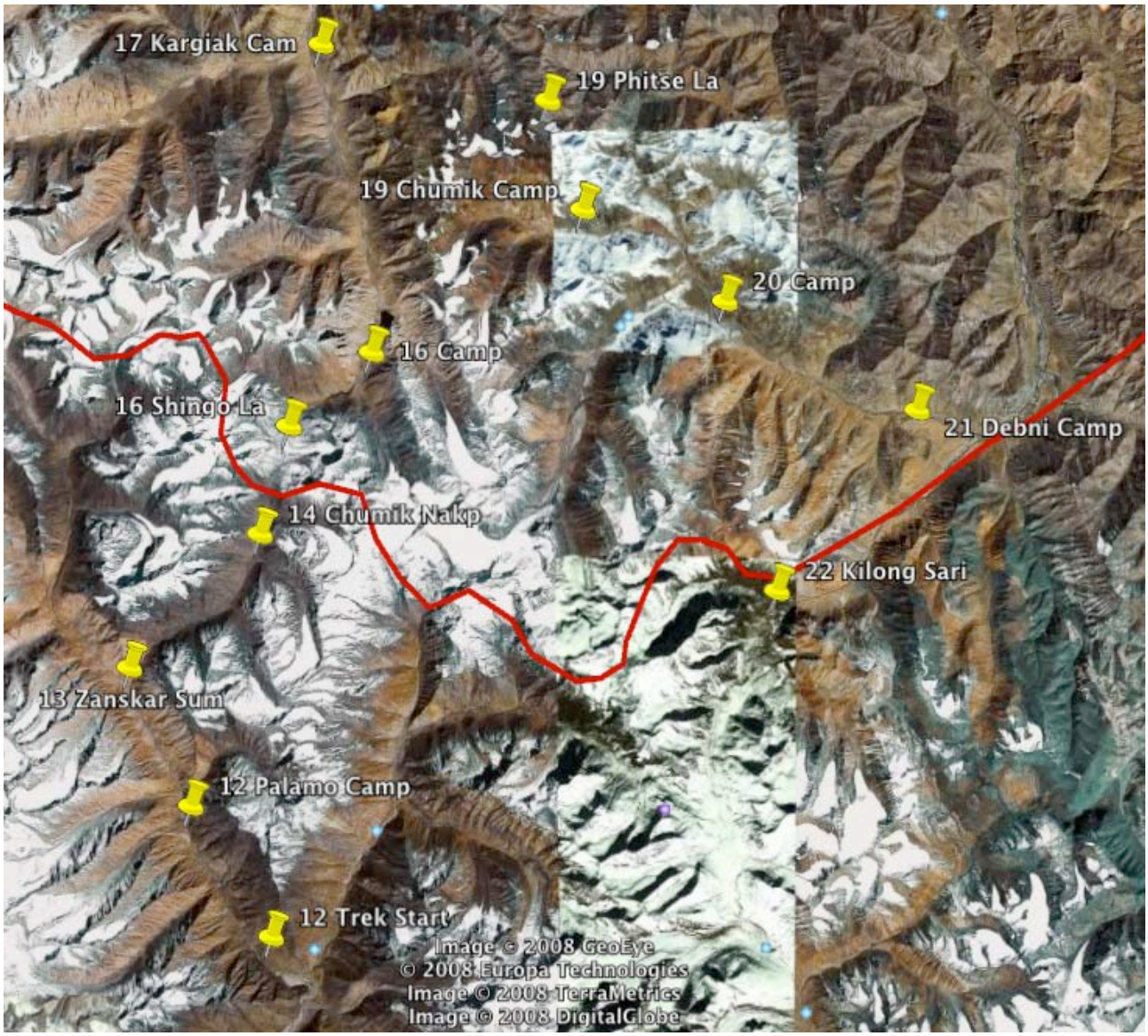
### Expedition Itinerary:

| Day | Objective | Ascent | Descent | End-of-day altitude | Notes |
|---|---|---|---|---|---|
| 1 | Darcha to Palamo | 327m | | 3677m | Trek starts at 3350m. Easy acclimatization day. |
| 2 | Palamo to Zanskar Sumdo | 261m | | 3938m | |
| 3 | Zanskar Sumdo to Chumiknakpo | 517m | - | 4455m | Over glacial debris |
| 4 | Rest Day | - | - | 4455m | |
| 5 | Chumiknakpo to Lakhang | 594m | 581m | 4468m | **Crosses Shingo La (5049m)** via extensive snowfields |
| 6 | Lakhang to Kargiak | - | 397m | 4071m | |
| 7 | Kargiak to Zingchen | 528m | - | 4599m | |
| 10 | Zingchen to Chumik Marpo | 961m | 807m | 4753m | **Crosses Phitse La (5560m)** |
| 11 | Chumik Marpo to unnamed campsite | - | 520m | 4453m | |
| 12 | Unnamed campsite to Debni | - | 24m | 4429m | |
| 12 | Debni to Sarai Keylong | 71m | - | 4500m | |
| 13 | Drive Sarai Keylong to Soland Nalah | - | - | - | |
| 14-18 | Day I: Solang Nalah to Dhundi (2813m) via jeep then trek in to Bakah Thatch Base Camp (3328m)<br>Day II Climb to Advanced Base Camp (3825m)<br>Day III: Peak attempt 1<br>Day IV: Peak attempt 2<br>Day V: Descent to Dhundi (2813m) then jeep to Manali | | | | |

### Altitude Profile

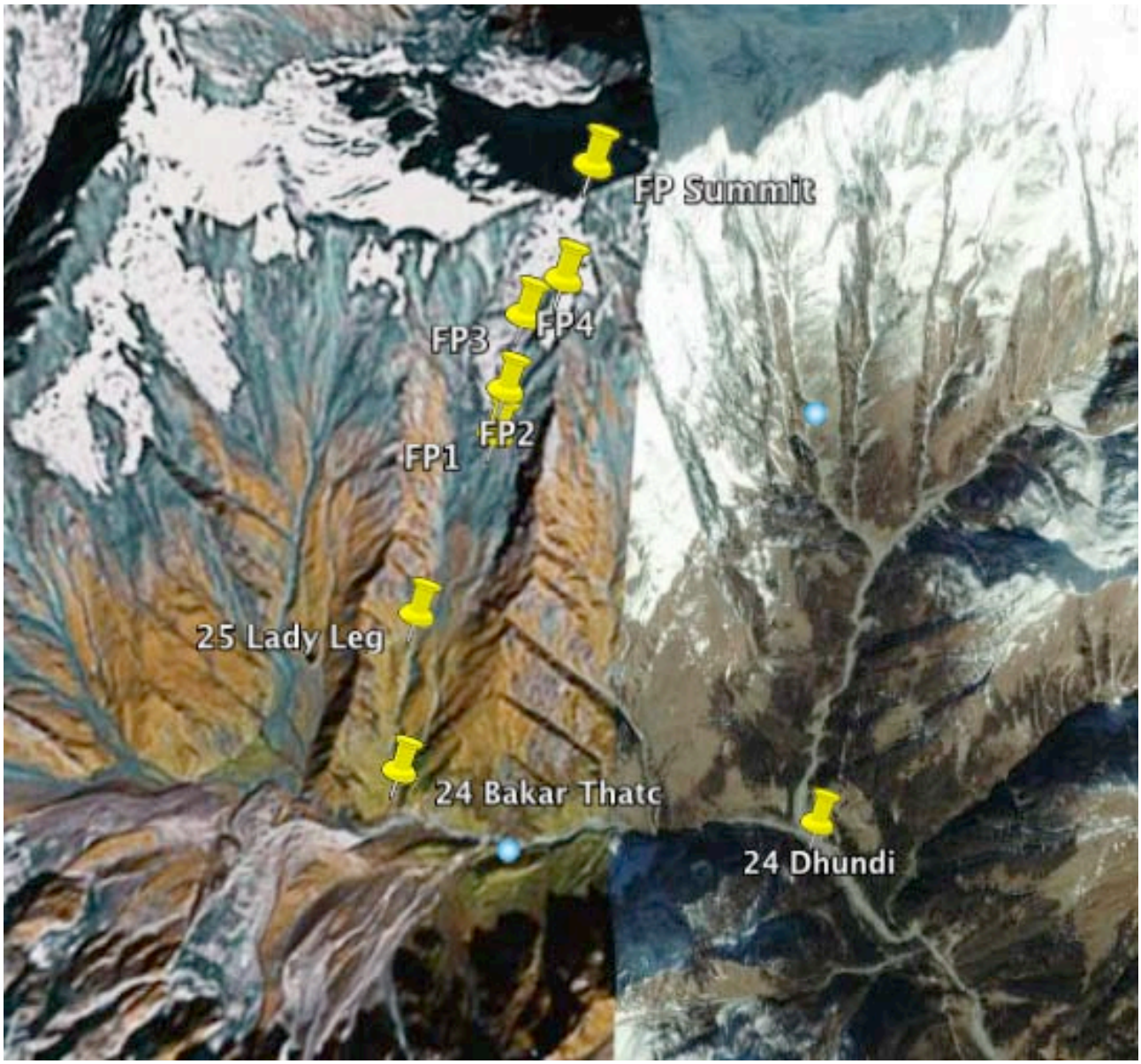


**Shingo La-Phitse La Route**



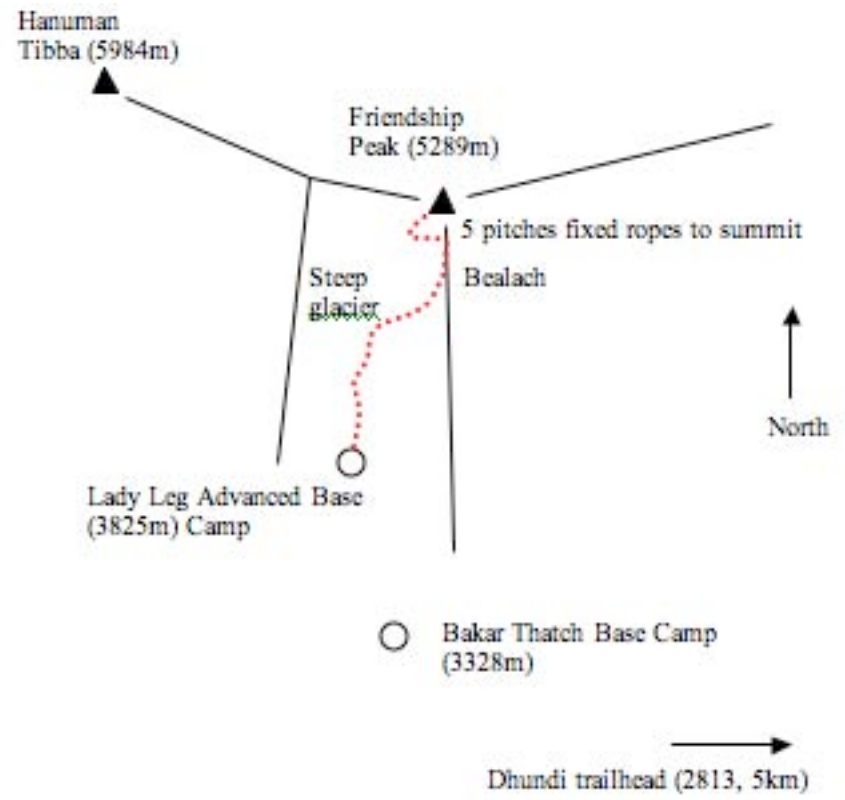

*Markers designate camps reached each night (with numbers referring to date: e.g. 13 Zanskar Sum = 13th June 2008). All points are taken from GPS readings on the expedition and transferred to Google Earth.*

**Friendship Peak Route**




*Ascent of Friendship Peak from base-camp at Bakar Thatch, to advanced base-camp at Lady Leg and then via the North Ridge of Friendship Peak to the summit at 5289m. All points are taken from GPS readings on the expedition and transferred to Google Earth.*

### Friendship Peak Sketch Map




### Route History

Whilst our ascent of Friendship Peak was not a first ascent, the circumstances in which it was first climbed are not recorded. The route followed is the standard route used by climbers acclimatizing for an ascent of Hanuman Tibba, which was first climbed in 1955. To our knowledge, we have been the sole scientific expedition to this Friendship Peak.

### Suggested New Routes

There is an impressive and steep rock-ridge connecting Hanuman Tibba with Friendship Peak, which local research suggests has not been traversed. This looks to offer sustained and moderately difficult mixed climbing.

### Mountaineering Elements

The ascents of Shingo La and Phitse La are non-technical, and although they require ice-axe and crampons, there is no necessity for movement as a roped party. Indeed, our expedition managed (with difficulty) to take pack-horses over both passes (see photo below). The major objective danger during this phase of the expedition comprised river crossings. These were frequent, rapid and deep to mid-thigh. Crossing early in the morning is recommended, when flow from glacial melt-water is at its lowest.

The ascent of Friendship Peak was a more involved mountaineering endeavour. The first summit attempt left advanced base-camp at 0430 and was compelled to turn-around at 1100, a mere 170 vertical metres from the summit. This was due to sustained rockfalls released by the heat of the morning sun on ice-bound rocks. The second summit attempt left the following day at 0200, moving quicker and summited at 0750. The route initially involved a 700m ascent on glacier with few crevasses and easy navigation to a col on the North Ridge of Friendship Peak. We then ascended as roped party along the ridge, before crossing the face at 5050m below a series of cliffs. The final ascent of the summit pyramid was via 5 pitches of fixed rope; two of these were ice-pitches (one at 70°, requiring front pointing whilst jumaring), and three of nevé. On descent, these pitches were abseiled.

*Negotiating crevasses at 5050m on Friendship Peak*

The expedition was timed so as to precede the monsoon, and this meant there was generally very little precipitation (particularly between Shingo La and Phitse La, which lies within the Himalayan rain-shadow). However, the monsoon broke on the second summit day (27 June) as the party were descending. This resulted in a white-out and electrical storm. The party descended rapidly without incident to return to advanced base camp.

## Administration and Logistics

*Research materials and information*

Potential routes were investigated using Charlie Loram's excellent 'Trekking in Ladakh' guidebook (Trailblazer, 1999) and the rather less accurate Lonely Planet 'Trekking in the Indian Himalaya' (which had frequent height inaccuracies). Editions Olizane maps were used throughout the expedition. These were clear, generally accurate and were compatible with GPS systems. Google Earth was invaluable in planning the route and is to be recommended for obtaining an impression of the landscape prior to purchasing expensive maps.

*Timing and Equipment Testing*

All new mountaineering equipment was put through its paces during the Scottish winter season prior to the expedition. This provided weather to match (or even exceed) the worst the Himalayas were able to offer! Research equipment was tested extensively prior to departure, to ensure that research sessions did not last dangerously long in cold, exposed testing sites.

*Visas and permits*

Standard Indian tourist visas were obtained. An Indian Mountaineering Federation (IMF) permit was required for the ascent of Friendship Peak. Although we attempted to obtain this in advance, the resulting bureaucracy and claims by IMF that this process would take up to 6 months meant we were reduced to sending two members of the expedition to the IMF headquarters in New Delhi to arrange the permit in person. There was no problem in doing this.

*Fund Raising*

The expedition was able to raise almost £7000, the majority of which came from external grants and which are detailed in Appendix A. Our primary supporters were the University of Edinburgh Development Trust, the Royal College of Physicians of Edinburgh, the Mount Everest Foundation and Ede & Ravenscroft. The Winston Churchill Memorial Trust additionally paid the entirety of the leader's expenses. Fundraising events, whilst good at building *espirit de corps*, succeeded in raising only a modest total. Future expeditions would be advised to concentrate their time and efforts on approaching grant-giving trusts and academic prizes.

*Finances*

Money was held in a central expedition account, from which payments for group equipment were made. Owing to the twin difficulties of transferring large sums of money to India, and of withdrawing very large sums of money from a UK account in India, money remaining in this account was then disbursed equally to expedition members, who had the responsibility of withdrawing an equivalent amount in Indian Rupees (Rs) once in India. This was used to pay for guides, porters, food and local transport. A breakdown of accounts can be found in Appendix A.

*Insurance*

Insurance was taken out with the British Mountaineering Council, with explicit provision for helicopter evacuation.

*Porterage and Guiding*

Porters, guides and food were arranged by the excellent Roopu Negi of Himalayan Adventures in Manali. The expedition used two guides, 3 cooks/kitchen staff, 4 horsemen and 15 horses. For the ascent of Friendship Peak, an additional 2 guides were utilized. All were excellent, and Himalayan Adventures can be wholeheartedly recommended to any future expeditions in this area of India.

*Expedition pack horses crossing Shingo La at 5040m*

*Food and Accommodation*

Food was provided by Himalayan Adventures. This was plentiful and of extremely high standard. The majority was bought locally (in Manali), although this was supplemented by mutton bought *en route* and fish caught in mountain streams. Additional morale-boosting snacks from the UK were also eaten. Water was purified by boiling. Accommodation was in 2-man A-frame tents rented in India. These were adequate for our purposes, although may not have stood up to more severe Himalayan storms. A mess tent proved invaluable for eating in the cold evenings and for using as a research tent.

*Communication*

All communication with the host-country occurred via email, which is easily accessible in India.

*Risks and hazards*

A formal risk assessment is attached as Appendix D. The expedition originally planned to climb in the Karakoram range of Pakistan, although this plan was revised in view of the continuing political instability in that country. The biggest hazards faced were rock-fall on Friendship Peak, and river crossings.

*Medical Arrangements*

The expedition was made up of medical students, four of whom attended the Wilderness Medicine Training Advanced Medicine for Remote Foreign Travel Course. We carried a comprehensive medical kit, with drug treatments for diarrhoea and vomiting, acute mountain sickness, high altitude pulmonary and cerebral

oedema and various other conditions. We also had an extensive trauma kit, including Sam splints, and carried saline for IV fluid resuscitation. Vaccinations were obtained as recommended by the Regional Infectious Diseases unit in Edinburgh.

There was one case of severe AMS requiring descent. This resolved after a descent of 150m, and the sufferer was able to rejoin the expedition without difficulty the next day. There was also one case of ? HAPE, which was ruled out on clinical examination. There were two cases of diarrhoea and vomiting requiring ciprofloxacin.

*Environmental and social impact*

An environmental and social impact assessment was conducted, and is appended as Appendix E. It is to be remembered that although Manali sees many western visitors, the villages in the Zanskar valley do not and are conservative societies. Future expeditions should consider the need for appropriate dress in this context.

*Photography*

An official expedition photographer was designated, who was equipped with a Nikon D70 digital camera. The two full battery packs taken were sufficient for ~ 1000 photos. A polarizing filter was very useful at altitude for cutting down on glare. Future expeditions would be recommended to also take an additional wide angle (~14mm) lens in addition to a standard zoom. A lightweight tripod was also essential for capturing low light shots, as below:

*Hanuman Tibba at dawn, seen from the slopes of Friendship Peak.*

## Conclusions

The expedition departed for India with the following aims:

1. To climb the Shingo-La and Phitse La passes, thereby completing a remote and high-altitude (>5000m) traverse of an underexplored region of the Zanskar Himalaya.
2. To carry out publishable medical and physiological research into cognitive effects of high altitude.
3. To successfully ascend Friendship Peak (5289m)

Of these, the first and last were certainly achieved. Of the second, all data were collected as planned despite challenging environmental circumstances, and these are currently being analysed with a view to publication in academic journals later this year. By these strict criteria alone, the expedition must be declared a success. However, the success or otherwise of an expedition extends far beyond this narrow remit. The challenge of leadership, the team-work and camaraderie which developed, the physical challenge of trekking and climbing at high-altitude and the sense of adventure in an environment totally isolated from the modern world all combined to produce a truly memorable expedition for all those involved.

It is too early to assess the implications of the research and the strengths and weaknesses of the research protocol, although these will be fully discussed in any ensuing scientific papers. These will also highlight the possibility of further academic work to extend the scope of this current project.

For the benefit of future expeditions, it is important to finish with a number of general recommendations to complement the specific suggestions scattered through the earlier parts of the report.

1. It is never too early to commence planning an expedition, and it is impossible to plan too thoroughly. Although guidebooks are useful for providing background, there is no substitute for talking to as many people as possible who have experience of the area or of the style of expedition.

2. Grants tend to snow-ball. Although it can takes months of hard-work to secure the first external funding, once a grant-body has seen that you have already been able to attract money, it becomes correspondingly easier to succeed with grants. Do not be afraid to apply widely and to ask for more money than you expect to receive. Our most surprising grant was £1500 from Ede and Ravenscroft (the university-gown tailors).

3. There is no point in setting off on an expedition if the outcome is already known; pick a unique angle that hasn't been pursued before. A research element adds significantly to the intellectual satisfaction of an expedition, as well as to your fund-raising ability.

4. Agree expedition roles at the outset. A clear chain-of-command, with a leader responsible for making overall decisions, and individual personal responsibilities for each participant, does much to engender an espirit de corps.

5. Do not be rebuffed by setbacks or by those who attempt to persuade that what you want to do is not possible. You may be compelled to alter your plans (as we were in relocating from Pakistan to India), but it is generally possible to overcome or circumvent such difficulties. However, do not underestimate the Kafkaesque bureaucracy that seems to dominate governments in some parts of the world.

To any future expeditions, good luck!

David Hall
Richard Benson
**Expedition Leaders, Edinburgh Altitude Research Expedition 2008**

**Acknowledgements**

The expedition is very grateful to the following:

Roopu Negi, Managing Director, Himalayan Adventures, Manali, HP, India – *for providing guides, porters and administrative support*

Professor Ian Deary, University of Edinburgh – *for acting as academic supervisor to the expedition*

Professor Baljean Dhillon, Consultant Ophthalmic Surgeon; Dr Daniel Morris, ophthalmic registrar – *for initial research support*

Major Jonjo Knott, RAMC – *for medical and expedition advice*

Drs Fanney Kristmundsdottir and Simon Riley, University of Edinburgh Medical School – *for support, encouragement and advice.*

Dr Kate Heal, The University of Edinburgh Expeditions Committee

The Winston Churchill Memorial Trust - *for supporting the leader's financial expenses.*

The University of Edinburgh Development Fund

The Mount Everest Foundation

The Edinburgh Wilderness Medicine Society

The Royal College of Physicians of Edinburgh

Ede and Ravenscroft

Scarpa

Lowe Alpine

Rab

## Appendix A: Summary of Finances

### Expenses

| | |
|---|---|
| Flights: Birmingham to Amritsar | £500 x 10 = £5000 |
| Equipment: personal equipment, GPS, research equipment | £5000 |
| Porters, guides, food, fuel for 21 days and jeep transfer from Manali to trailhead at Darcha (estimated at £35/person/day) | £6500 |
| Internal transport from Amritsar to Manali and return | £500 |
| Maps and guidebooks | £100 |
| BMC Alpine and Ski Insurance | £100 x 10 = £1000 |
| IMF Peak Fee | £350 |
| | |
| **Total:** | £18450 |

### Personal Contribution

| | |
|---|---|
| Flights | £5000 |
| Equipment | £400 x 10 = £4000 |
| Personal contribution to guiding and portering fees | £170 x 10 = £1700 |
| Insurance | £1000 |
| **Total:** | £11,700 |

### Funding Received

| | |
|---|---|
| Royal College of Physicians of Edinburgh Myre Sim Bursary | £750 |
| University of Edinburgh Development Fund | £2000 |
| Edinburgh Wilderness Medicine Society Grant | £1400 |
| Mount Everest Foundation Grant | £600 |
| Ede and Ravenscroft Prize | £1500 |
| Profits from fundraising ball | £500 |
| | |
| **Total:** | £6750 |

### Other Funding

The Winston Churchill Memorial Trust generously supported David Hall's expedition expenses.

### Confirmed Equipment Sponsorship

The expedition is grateful to the following companies for equipment sponsorship: Lowe Alpine, Rab, Scarpa, Grivel.

### Appendix B: Bibliography

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### Appendix C: Distribution List

The University of Edinburgh Expeditions Committee
The University of Edinburgh Development Trust
The Winston Churchill Memorial Trust
The Royal College of Physicians of Edinburgh
The Mount Everest Foundation
The British Mountaineering Council
The Royal Geographical Society

### Appendix D: Risk Assessment

| | |
|---|---|
| School Assessment No. | |
| Title of Fieldwork Activity: | Clinical research |
| Location(s) of Work: | Himachal Pradesh-Zanskar, Northern India |
| Duration (incl. dates From / To) : | 8 June – 5 July 2008 |

Brief Description of Fieldwork:
Characterization of intra-individual variability of reaction times as a marker of cognitive change associated with high altitude.

**Hazard Identification:** Identify all the hazards; evaluate the risks (low / medium / high) and describe all necessary control measures.

| **Hazard (s)** | **Risk** L / M / H | **Control Measures** | **Risk after Control** L / M / H |
|---|---|---|---|
| **Physical Hazards**<br>Cold weather conditions<br>Hazards of glacier travel<br>Altitude hazards (AMS, HACE, HAPE)<br><br>(e.g. extreme weather conditions, cliffs, caves, mountains, marshes, quicksand, fresh / seawater, mines, quarries, tides) | H | Cold weather: all participants will bring appropriate clothing and equipment (e.g. down jackets, suitable gloves, sufficiently warm sleeping bags, etc). Weather forecasts will be obtained at Manali before beginning the expedition, and in the event of extreme weather the start will be adjusted as required.<br><br>Evacuation: in the event of serious injury or illness requiring evacuation, expedition members will in the first instance be considered for evacuation by porter to the nearest roadhead and thence by road to Manali. If isolation or the nature of injuries renders this impractical, helicopter rescue will be arranged. All expedition members have insurance specifically covering this eventuality.<br><br>Mountaineering hazards (ascent of Friendship Peak) best mountaineering practice will be followed and all expedition members have completed winter skills courses in the UK or already have substantial mountinaeeringh experience. All participants will wear helmets where there is judged to be danger of rockfall, and will be equipped with ice-axes, crampons and harnesses. Ropes will be used if required (as judged by the expedition safety officer, Rob Young) on the ascent/descent of Friendship Peak, and also if required during the crossing of the potentially snow-bound Shingo La and Phitse La passes.<br><br>River crossing: although several river crossings are expected, these will be carried out with | M |

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| | | team-members roped up and following standard river-crossing techniques where this is judged to be appropriate.<br><br>Altitude hazards: the profile of the trek is designed to minimise the development of altitude-related illness with an average climb of 350m during the ascent phase, plus one mandatory rest day and a further optional rest day. All participants will be educated about the dangers of altitude sickness, and will additionally completed a Lake Louise Score questionnaire each evening. Participants judged to be suffering from mild AMS will be escorted to a lower altitude at the earliest opportunity. Although the ascent profile of the trek is relatively shallow, porter evacuation means that participants with mild AMS could be escorted down 300m in a matter of hours. A descent such as this frequently leads to symptomatic improvement. If clinical signs of significant AMS (or HACE/HAPE) develop, then helicopter evacuation will be organised.<br><br>The expedition carries adequate supplies of dexamethasone and nifedipine for treating HACE and HAPE respectively, as well as standard doses of acetozolamide for the treatment of severe AMS. | |
| **Biological Hazards**<br>Gastroenteritis<br>Malaria<br>Other infectious diseases | M | Gastroenteritis is common amongst travellers to India. On the trek, hygiene will be emphasised, with alcohol gel used where running water is not freely available. The group are taking a 'Nomad Adventure Group Expedition Medical Kit', which is designed for parties of this size to be self-sufficient in treating minor trauma and travel illnesses for a 3 week expedition.<br><br>Malaria is a hazard in the low-lying plains, but not at the altitude of the trek. We will consult with a travel GP regarding the requirement for malaria prophylaxis.<br><br>Two members of the group have consulted the Travel Clinic at the Western General Hospital, Edinburgh, for generic advice on which antibiotics to take (for e.g. the treatment of gastroenteritis) and which vaccinations are required for the group.<br><br>All members of the expedition have declared pre-existing medical conditions, and this information will be carried on both the trek and left with a designated contact in the UK. Asthmatics will carry an appropriate supply of | L |

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| | | medication and discuss the trip with their GP. There are no diabetics on the trip. | |
| **Chemical Hazards** (e.g. pesticides, dusts, contaminated soils, chemicals on site) | L | None | L |
| **Man-made hazards** (e.g. machinery, electrical equipment, vehicles, insecure buildings, slurry pits, power and pipelines) | L | Local roads liable to landslip. Whilst unlikely to affect us directly, it may delay transport to/from the trailhead. | L |
| **Personal Safety** (e.g. lone working, attack on person or property, first aid) | M | There is a low risk from political instability or serious crime. There will be no lone-working, and single women will not be traveling by themselves. | L |
| **Environmental impact** (e.g. refuse, pollution, disturbance of eco-systems) | M | All rubbish will be transported out. Human refuse will be buried. The trek passes through several villages, which have come to subsist on trade generated by passing expeditions. This expedition will support villagers by purchasing supplies where required. However, there is no plan to hire accommodation on the trek as we will be carrying our own tents and pitching these away from villagers. Porters will be arranged by the guide/head-porter from local villages, thereby contributing to the local economy. | L |
| **Other hazards** (e.g. procedural, manual handling) Please specify. | | N/A | |

**Continue on separate sheet if necessary*

**Emergency Procedures:** Specify arrangements for first aid, special emergency procedures, survival aids, communication, etc.)

As medical students, we are all trained first-aiders, and will be carrying a large, group expedition first-aid kit. Two expedition members have attended the Wilderness Medicine Training 'Advanced Medicine for Remote Foreign Travel' Course, which gives training for medics on expedition injury and illness management. We have insurance specifically catering for the possibility of helicopter evacuation.

**Additional Information:** Identify any additional information relevant to the fieldwork activity, including supervision, training requirements, information, specialist equipment or clothing, inoculations, etc.

Training: all participants will have attended a winter mountaineering skills course, or have extensive winter mountaineering experience.

**Contact Information:** Include details of both the University designated contact and on-site contact.

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|---|---|---|
| **University** | Dr Fanney Kristmundsdottir | |
| College of Medicine and Veterinary Medicine<br>College Office, Medical School<br>The University of Edinburgh<br>Chancellor's Building<br>49 Little France Crescent<br>Edinburgh | | |
| **On-site** | Roopu Negi | |
| Himalayan Adventurers-Manali<br>Opp. Tourist Information Centre-Post Box 44, The Mall- Manali – 175131 (H.P) India.<br>Phone: ++ 91 1902 253050, ++91 1902 252750. | | |

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|---|---|---|---|
| Has necessary training and information been given? | Yes ☒ | No ☐ | N/A ☐ |
| Is there adequate provision for those with health problems or disabilities? | Yes ☐ | No ☐ | N/A ☒ |
| Are there adequate First Aiders available? | Yes ☒ | No ☐ | N/A ☐ |
| Is there suitable supervision (i.e. Staff to Student ratio)? | Yes ☐ | No ☐ | N/A ☒ |
| Is permission required to work on site? | Yes ☐ | No ☒ | N/A ☐ |
| Are there suitable travel arrangements and licensed drivers? | Yes ☒ | No ☐ | N/A ☐ |
| Is adequate insurance cover in place?<br>*(Contact Finance Office for advice, 50-9154)* | Yes ☒ | No ☐ | N/A ☐ |
| Have all participants submitted next of kin information to field trip organiser / School Office? | Yes ☒ | No ☐ | N/A ☐ |
| Have route notification schedules been provided to Police or Coastguard? | Yes ☐ | No ☐ | N/A ☒ |

**Assessment carried out by:**

| | | | |
|---|---|---|---|
| Name: | David Hall | Date: | 15/12/2007 |
| Signature: | | Review Date: | |
| Title: Expedition leader | | | |

**Assessment Authorised by Head of School / Fieldwork Supervisor:**

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|---|---|---|---|
| Name: | | Date: | |
| Signature: | | | |

## Appendix E: Social and Environmental Assessment

*1. Direct impact of the research upon humans, other animals and the environment (data gathering, sample collection, methods/techniques, sample sizes... for the organisms/habitats you plan to study.)*

We are measuring the effect of altitude on intra-individual variation in reaction times as a marker of cognitive change. These studies will be performed throughout our expedition to traverse the Shingo La and Phitse La passes and ascend Friendship Peak in Himachal Pradesh and Zanskar, India.

All studies are both physically and mentally non-invasive. We plan to collect data from all members of the expedition (with their written, informed consent) including ourselves, the investigators, giving a sample size of n = 10. This will require approximately 15-20 min testing per day for each participant. The experiments will involve reaction times test using a small, specially-designed, handheld computer, and non-invasive baseline physiological measurements (arterial oxygen saturation, pulse, blood pressure, respiratory rate). Data will be stored on paper records, and anonymised appropriately. The results will be written up as a research paper that will be submitted for publication.

The data collection will have no physical environmental impact.

*2. Indirect impact of the project upon humans, other animals and the environment*

The project will be conducted throughout our traverse of the Shingo La and Phitse La passes and ascent of Friendship Peak, although it should be noted that none of us are participating solely for the purpose of research: we are going for the challenge and enjoyment of the trek itself. The challenge and risks of trekking and its impact on the local environment are all indirect but important aspects of the project.

Potential effects on the environment include:
- Waste and sewage
- Pollution from vehicle emissions
- Path erosion

Potential effects on expedition members that we have identified include the risks of the mountain environment (including rockfall, cold weather and altitude), and the remoteness of the trek should medical evacuation be necessary. These are addressed comprehensively in the Field Risk Assessment Form (Appendix D).

The trek passes through several villages, which have come to subsist on trade generated by passing expeditions. This expedition will support villagers by purchasing supplies where required. However, there is no plan to hire accommodation on the trek as we will be carrying our own tents and pitching these away from villagers. Porters will be arranged by the guide/head-porter from local villages, thereby contributing to the local economy. Bilingual local guides will assist in communication with local people.

*3. Attempts to minimize negative factors identified in 1 and 2:*

We have already attempted to minimise many of the negative environmental impacts by limiting the size of the expedition to 10 UK members. This reduces the number of porters required, transport and food requirements and the amount of waste produced by the expedition, although these aspects need to be considered.

- Porters: Guides will be hired locally in Manali and porters at the trailhead at Dhacha; the number required kept to a minimum by carrying most of the equipment ourselves.
- Supplies: Food and fuel supplies will be obtained in Manali. Care will be taken to assure fuel is stored properly to avoid spills which could contaminate soil/groundwater.
- Transport: Public buses from Amritsar to Manali will be used. Local jeep hire will be needed for the last leg of the journey to the start of the trek (Manali-Dharcha).

- Waste disposal: Human refuse will be buried, taking care to do so away from water sources, and toilet paper carried out. Rubbish such as food packaging will be transported at least as far as Manali, the nearest town with proper waste disposal facilities.
- Path erosion: We will liaise with the guides to ensure we use standard routes across the passes.

*4. Permits/licences required and other cultural considerations*

As a student-led project, ethical approval has been obtained from the Medical School Committee for the Use of Student Volunteers in Research Projects.

The Phitse La and Shingo La traverse and the journey to the start of the trek does not currently require special permits. The ascent of Friendship Peak requires an IMF Trekking Peak permit, which is currently being processed. Three members of the expedition will arrive in Amritsar a week before the start of the expedition and will confirm any last minute arrangements.

Finally, local customs of note relate to the traditional nature of north Indian society. We will respect these cultural differences, including wearing modest clothes. Although we are not aware of any local customs specifically relevant to our project, should any become apparent we will take guidance from our guides.