The Project	Project name	Energy Balance
	Project expedition	2008 – Hidden Valley
	Aim of project	i) Determine whether increasing energy intake can reverse weight loss at altitude. ii) Determine whether increasing carbohydrate intake is feasible and can increase physical performance at altitude. iii) Determine what physiological and psychological factors increase risk of acute mountain sickness.
	Project funders	Science in Sport (dietary interventions, funding for outcome measures), Ministry of Defence (Army) (funding for outcome measures), Mountain Equipment (researcher personal equipment), Panasonic United Kingdom (Toughbook laptops), Qatar Airways (Carriage), Polar United Kingdom, Optimal Performance, nSpire Health Inc, Vitech Scientific, and Digitalscales.com (scientific equipment)
Project staff	Lead person	Jamie Macdonald and Sam Oliver
	Assistants	Students from Bangor University, plus Petra Golja, Robert Szymczak, Stephan Sanders, Catherine Williams, Zoe Smith and Emma Lloyd-Davies.
	Institutes involved	Extremes Research Group, Bangor University
Data collection	What you did to the subjects	In half of the expedition group we supplemented diet with carbohydrate energy drinks and gels. In the remaining half we gave placebo drinks and gels that had no calorific content.
	What data you collected	i) Body composition by underwater weighing (muscle mass; fat mass). ii) Physical performance (time to walk a set distance whilst walking as quickly as possible and carrying a rucksack; daily physical activity on rest days; sub-maximal step test performance). iii) Illness (acute mountain sickness; anxiety; infections; resting heart rate; blood oxygen concentration; fluid intake).
	What you did with the data afterwards	i & ii) For body composition and physical performance: We took the data collected before, during and after the expedition and compared the participants allocated to receive the carbohydrate supplementation with people who received the placebo intervention. iii) For illness: We took the data collected every day during the expedition and determined whether any measures predicted who would got acute mountain sickness during the expedition.
Photos	Attach 2 photos of research in action!	i)  ii)

		
	Photo captions	i) Completing the walking test at 5192 m (French Pass). ii) Post expedition assessment of body composition using underwater weighing (Marpha).
	Who took the photos?	Stephan Saunders
The results	What did you find out? (positive & negative results)	i) Supplementing diet with high energy carbohydrate did <u>not</u> prevent the muscle and fat loss common with high altitude exposure. ii) Supplementing diet with high energy carbohydrate was feasible and <u>increased</u> physical performance. iii) People with reduced fluid intake and/or infections such as colds were <u>more likely</u> to get acute mountain sickness.
	How has this helped high altitude research?	i) This study disproved the assumption that weight loss only occurs at altitude because of decreased food intake. To determine the cause of weight loss other factors should now be investigated. ii) This study suggested that the performance benefits of taking carbohydrate at sea level are also present when taking carbohydrate chronically at high altitude, potentially helping those at high altitude to reduce exertional effort, to achieve work and leisure objectives and to improve safety. iii) This study identified that increasing fluid intake and preventing infections are simple ways to reduce risk of acute mountain sickness.
	How has this helped sea level medicine?	i) The study has justified research on the use of simulated altitude (such as hypoxic tents) to enhance weight loss in patients who are obese. ii) The study speculatively suggests that carbohydrate supplementation may decrease exertional effort in patients with conditions such as chronic obstructive pulmonary disease, potentially improving physical activity levels in this fatigued population. iii) N/A.
Sharing the results	What papers have been published	i) Macdonald JH, Oliver SJ, Hillyer KS, Sanders SJ, Smith Z, Williams C, Yates DJ, Ginnever H, Scanlon E, Roberts E, Murphy D, Lawley JS, and Chichester EM. Body composition at high altitude: a randomized placebo controlled trial of dietary carbohydrate supplementation. *Am J Clin Nutr*; 2009; 90:1193–202. ii) Oliver SJ, Golja P, Macdonald JH. Carbohydrate Supplementation and Exercise Performance at High Altitude: A Randomized Controlled Trial. *High Alt Med Biol*; 2012;13:22-31. iii) Oliver SJ, Sanders SJ, Williams CJ, Smith ZA, Lloyd-Davies E, Roberts R, Arthur C, Hardy L, and Macdonald JH. Physiological and Psychological Illness Symptoms at High Altitude and their Relationship with Acute Mountain Sickness: A Prospective Cohort Study. *J Travel Med*; 19: 210–219.
	What conferences have been attended	1. Hypoxia, Lake Louise, 2009. "Body composition changes during high altitude exposure are not reversed by increasing energy intake". Selected as a Hot Topic.

		2. Birmingham Research Expeditionary Society Altitude Research Conference, Birmingham, 2009. "Improving performance at high altitude". 3. Hypoxia Symposium, Oxford, 2008. "Effect of carbohydrate supplementation during a high altitude expedition".
	What books include information	None
The future	What plans do you have to use the data in the future	Robert Szymczak collected data on sleep quality using our equipment. We hope to see this data published one day.
	What do you think should be researched next?	i) The cause of weight loss at altitude. ii) How carbohydrate supplementation improves performance. iii) The measurement and cause of high altitude headache and high altitude infections.
	Any other comments / advice for others?	Ensure all expedition members (including other researchers) are motivated to complete your research, by involving them at the research design stage.