which have adapted their metabolic activities to life at low temperatures and should, if material is made available, provide an interesting field for research.

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THE PHYSIOLOGY OF SKI-ING

[Review of "Physiology of skiing", by Hohwü Christensen and P. Högberg, *Arbeitsphysiologie*, Bd. 14, 1950, p. 292–303.]

This paper gives the results of physiological observations on a number of skilled and well-trained skiers, made either on level terrain, or going uphill. It is now clear that it is possible when ski-ing to take harder physical exercise (as judged by the amount of oxygen consumed) than in any other way, except, perhaps, when running. Ski-ing makes use of practically every muscle in the body and a high output of energy can be maintained for long periods. In one case 30 km. of level terrain was covered in 1 hr. 20 min., this being well above the world's record for running the same distance.

A man ski-ing for 6 hours at 6 km.p.h., carrying a 30 kg. rucksack, may expend 4900 kg. cal. of energy. Christensen and Högberg suggest that a ski-er carrying such a load may need a daily intake of up to 7000 kg. cal., which is well above what is normally considered necessary when preparing a ration scale for an expedition. Certainly no similar data have been available in the past for expeditions planning to use skis.

A comparison is made of the energy expended in covering a given distance at fixed speed. Compared with walking on soft snow, snowshoes give an energy saving of 20 % and a further 15 % is saved by skis. Even in climbing a gradient of 1 in 6, skis show a substantial saving of energy over snowshoes. Carrying a 30 kg. load in a rucksack adds 40 % to a man's energy expenditure, but uses 15 % less energy than pulling the same load on a sledge weighing 8 kg. Nevertheless the sledge may still be preferable as it saves fatigue of the back muscles. This assertion is certainly well-founded; the continual heavy load on the muscles of the back appears to impede the circulation and cause pain.

Christensen and Högberg point out that in ski-racing the very high energy output places a considerable strain on the heart and circulatory system. They record many pulse-rates of 220–60 in youths at the end of a 5 km. race, and the oxygen intake values in these experiments are nearly the highest ever recorded.

The authors conclude that ski-ing is the most economical method of travelling on snow surfaces, whether they be hard or soft. Anyone intending to make a long journey on skis would do well, in planning food supplies, to consider these figures for energy expenditure.

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A GREENHOUSE IN THE ANTARCTIC

[The following note describes an experimental greenhouse used at Stonington Island, Marguerite Bay (Falkland Island Dependencies Survey, Base E), in 1946–47.]

In designing a greenhouse for use in the Antarctic, allowances must be made for such hazards as excessive snowfall, high winds, and very low temperatures. It should not be forgotten that snow drifts may enable sledge dogs to roam on to the roof.

At Stonington Island it was therefore decided to build a "lean-to", the only entrance being through the wall of the hut directly into the greenhouse. Thus, on opening the greenhouse door, air from a comparatively warm room would enter the greenhouse rather than cold air from outside. The greenhouse was built against one wall of the workshop, which was heated by a slow-combustion anthracite stove, and fitted with a boiler and set of 2 inch pipes for heating the greenhouse. The stove was placed in the workshop opposite the entrance to the greenhouse. The other end of the water system was an open-ended 10-gallon copper tank. The water supply was maintained by adding ice to this tank. If at any time the heat became excessive, hot water could be run off and ice added.

The greenhouse itself was 6 ft. long by 4 ft. wide by 6 ft. high, sloping down to 4 ft. 6 in. The foundations were elongations of the main floor beams. The bottom 2 ft. of wall consisted of tongued and grooved weather boarding pinned to a framework of a 2 by 4 in. timber. The superstructure rested on this supporting wall. The framework was substantial and allowed of double glazing with a 2½ in. air space between the layers of glass. The spans of glass in the roof and sides were all single sheets, unlike those in temperate climates where small overlapping sheets of glass are used. This was to prevent thaw water getting under the overlap with subsequent freezing causing a break. The glass