COLD ADAPTATION

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Despite the widely held view that man does not carry out physiological changes to adapt himself to a cold environment, there is strong evidence that adaptation to cold does occur, but it is not as marked as the adaptation to heat, and is more difficult to measure. For this acclimatisation to occur, there must be adequate exposure of the body to the cold; merely living in a centrally heated building in a cold climate is insufficient, and the face can become severely frost-bitten after a short exposure to freezing temperatures, if there is even slight wind.

In the hut used by the British Antarctic Survey team, the average temperature was 11°C (52°F) at bench level, colder nearer the floor. Subjective observations included difficulty in sleeping, lack of manual dexterity, and a moderate diuresis. Those members of the team who had been in the cold environment for a year showed several physiological adaptations not possessed by more recent additions to the team. The acclimatised men were in a constant state of mild dehydration, they could work out of doors in a temperature just above freezing, and usually found it necessary to discard clothing to keep cool at 10°C (34°F). Adaptation was more difficult in older members of the team; it is more difficult for people over the age of forty to adapt to any climate. There is little accurate scientific evidence concerning cold adaptation; observations have been somewhat haphazard, owing to the constant temperature of the Antarctic, which is sub-zero except for an hour or two daily in the Summer, owing to the lack of suitable laboratory and other facilities, and owing to the difficulty in human relations that would ensue if detailed personal investigations were carried out extensively upon close friends and colleagues with whom the research workers have to spend all day, every day, for periods of many isolated months. A high morale is essential for survival under these extreme conditions.

An antarctic camp provides a unique environment for a research project, because of its climate, and constant availability of subjects. Tactile discrimination tests were carried out on acclimatised men and new arrivals, six in each group, with an age range of 20 - 35. The hand was exposed to air at -2°C in a wind-tunnel, at a wind speed of 5 m.p.h. for a constant time. Discrimination was tested by the ability of the subject to recognise a gap between two bars, a variable distance from each other, the smallest gap recognised being the subject's score for the test. Initially there was a significant difference between the two groups, the acclimatised being able to recognise a much smaller gap than the newcomers, but this difference had disappeared completely within six weeks. Initially

the skin temperature of the un acclimatised group was on average 24.1°C and of the acclimatised, 22.3°C ., the difference being that the acclimatised man lives in a perpetual state of mild vasoconstriction. All other subjective differences between the two groups and disappeared by the end of six months. Men on sledging parties, even in journeys of short duration, lost weight and complained of diuresis. The rehydration after a sledge journey took four or five days, and suggests that the state of hydration is dependant upon stress.

Frostbite is an ever present hazard of work in a cold climate, and is often difficult for the patient to recognise because of the anaesthetic effects of hypothermia. It is best recognised by another observer, and occurs when the acclimatisation has been overcome. It is much less common amongst the acclimatised, partly because of their vasoconstriction, and partly because of their experience of living in the environment. The best treatment is rapid warming, but prophylaxis is much better than treatment. During the period of the experiment, four of the acclimatised group contracted mild frostbite, compared with fourteen of the newcomers.

Although acclimatisation to cold can take place over a long period, it can be brought about in a short time by frequent exposures to cold. If man only adapted to the set of temperatures he has experienced could he if acclimatised to -5°C , achieve a comparable performance to a man acclimatised to -20°C . The colder exposure would probably induce quicker adaptation.

Summary

Tactile changes have occurred to the fingers in experiments carried out in an Antarctic Summer.

Circulatory changes of fingers at rest have occurred as a result of vasoconstriction during work in winter conditions.

The degree and duration of cold stress has a relationship with cold adaptation.

Factors concerned with the adaptation to cold are:

- Physique.
- Age.
- Clothing.
- Morale.
- Exhaustion.