evidence indicates heart failure as the immediate cause of death. It seems that much more information regarding changes in the human organism at the last thousand feet might be obtained from clinical wards with patients suffering from severe oxygen-want.

Much has been written on various aspects of the physiological problems of high altitude, but above 20,000 ft. the problem enters the realms of pathology and clinical medicine. The physiology at the lower altitudes may therefore be of little help in elucidation of what is taking place in the human organism at excessive altitudes. Certain systems and organs have been very fully studied at the lower altitudes, and this tends to magnify their importance. However, one system, namely, the alimentary canal, has perhaps not received the attention it deserves.

In the course of some feeding experiments with white rats, evidence has been obtained that, under very low oxygen pressure, toxic substances accumulate in the gut. The toxic substances come from the food and from the tissues, but are probably oxidized under normal oxygen pressure and rendered harmless. Certain articles of diet, particularly certain proteins, seem to be most potent in producing these effects. By excluding these proteins from the diet, the resistance of the rats may be definitely increased. These adverse proteins include casein, egg albumin, meat and fish. Various other proteins have been investigated and zein, one of the proteins of maize, gives the best resistance, but a diet of whole maize alone is of no protective value. Adding zein to a maize diet improves the result, so that the zein appears to contain some favourable factor.

Certain amino-acids of the proteins have been tested separately, and adverse effects are obtained with histidine, cystine and arginine. Under bacterial action, histidine gives rise to histamine, which may cause collapse and shock. Collapse is a symptom also of severe anoxia. It is possible also that poisonous compounds of guanidine may arise from arginine. Resistance to oxygen-want is increased also in rats fed on diets containing adsorbents, such as charcoal, fibre or paper pulp, and kaolin. These may act by removal of toxic products from the contents of the alimentary canal. The most favourable foods for increasing protection against oxygen-want include carrots (the most protective), parsnips, beetroot, apples and bananas, all of which have a low protein content and also contain some fibre. As stated above, zein is the best of the proteins, with gelatin second, but not nearly so good. Starch, glucose, fat, vitamins and salts seem to be inactive—that is, they do not affect the result one way or the other, and therefore may be used in addition to the above more favourable articles of diet.

Undoubtedly, bacteria are responsible mainly for the adverse effects with most of the protein foods. Cats cannot tolerate the conditions at 14,000 ft., and this may be due to their protein diet. The variation in resistance observed in man may be due in part to variation in protein content of diet and to variation in bacterial flora in the intestine. The full details of the above experiments are being published elsewhere.

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[1] McFarland, *J. Comp. Psychol.*, 24, 189 (1937).

Open Type Oxygen Apparatus

IT is suggested in NATURE of June 10 (p. 970) that the weight of this apparatus may possibly be still further reduced "by mechanical improvement of valves and cylinders"; and as weight reduction is so important, the question is worth considering. The first Vibrac (not Vibrax, as on p. 961) bottles ever made were used for the 33lb., 1,600 litre, 1924 apparatus. The weight of steel was thus reduced almost exactly from 4½ to 3½ times the weight of oxygen. the former figure applying to the first, or 1922, apparatus. Subtracting 19 lb., given in Mr. Peter Lloyd's article as charged bottle weight for the latest 1,000 litre apparatus, from the total weight of 25 lb., we get 6 lb. as the rough weight of the rest of the gear. This compares with 8 lb. in 1924, when the flow meter was not omitted.

Further weight reduction by mechanical improvement seems doubtful, and the only hope is for metallurgists to produce a steel justifying a working stress higher than 27 tons/sq. in. That is the figure when Vibrac bottles are charged at Wembley to 120 atm., and the pressure is raised to 132 atm. owing to a shade temperature of 113° F., the record for deck cargo on the route of transit.

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An Experimental Attack on some Problems of Physiological Genetics

SINCE 1937, experimental work with *Drosophila melanogaster* on two problems of physiological genetics has been in progress in this laboratory.

(1) *Experiments on the development of the mutant* aristapedia (ss^a) *which transforms the bristle on the antenna (arista) into a tarsus.* In ss^a-flies segmentation of the antennal disk starts two days earlier than in normal flies[1]. Goldschmidt[2] therefore assumed that at 2½ days of larval age an evocator which determines leg segmentation is present in the germ, and all disks in the proper stage of development will react to this stimulus by tarsus formation. In normal flies the undeveloped antennal disk will not react to this evocator. In ss^a-larvæ, however, the differentiation of the antennal disk is speeded up and the antennal disk will react simultaneously with the leg disk in starting tarsus segmentation.

If this explanation is correct, a compound of ss^a with different leg mutants should show the mutant effect on the legs also, on the antenna of ss^a, and mutants influencing the arista should show no effect on ss^a. Confirmatory results were obtained in several tests. Compounds of ss^a with *dachs* and ss^a with *thickoid*, mutants which influence the length and the thickness of the legs respectively, showed these leg effects on the tarsus-like part of the antenna in ss^a. A compound of ss^a with aristaless, a mutant reducing the arista and influencing the scutellar bristles, showed no effect on the antennæ of ss^a, but its usual effect on the bristles could be observed. Transplantations of antennal disks were performed between 400 larvæ of ss^a and normal at different stages of larval age from 2½ days to pupation. ss^a-Disks transplanted into normal larvæ always developed into leg-like structures; normal antennal disks transplanted into ss^a-larvæ developed into normal antennæ with aristæ. The negative results of these transplantation experiments can probably be explained by the fact that