INAUGURAL ADDRESS

By

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I would, in the very outset, like to thank the organising authorities of the Association of Physiologists and Pharmacologists for giving me the honour to inaugurate this Symposium on such a vital subject, "Physiological & Pharmacological problems at High Altitude."

Hitherto the problems of high altitudes have exercised the minds, mainly of the few adverturous persons who climb high mountains and the residents of the sparsely populated regions located at high altitudes. However, as a result of the Chinese attack on our northern borders, the picture has now changed. We have now to locate large bodies of troops, many of whom have never experienced cold or left the plains of India, at high altitudes in the snows of the Himalayas. Consequently, the problems of taking them to high altitudes, maintaining them there in a positive state of physical fitness and mental alertness, and treating them when they fall ill, have assumed a national importance. You will agree with me that a nation defends itself from external aggression not only by its Army, Navy or Air Force but also by its technical developments and scientific progress. It is, therefore, evident that if we wish to retain our Independence and drive out the agressors we—by this I mean our entire medical profession and more specially the Physiologists and Pharmacologists should put our shoulders to the wheel and provide a ready answer to this challenge of hypoxia and cold with its concomitant problems facing our jawans. In this connection I would like to recall the words of our Prime Minister "Research or perish". Therefore, our Physiologists must solve their problems or... It is, therefore, imperative that if we have to deploy our troops on our northern borders we must solve these problems. The main medical problems which arise at high altitudes are connected with hypoxia and cold.

We have to guard a vast border at high altitude. It is easy to see that it is not economical nor possible to maintain a huge force perpetually at these heights because of logistic problems owing to difficult terrain and lack of communications. So it is obvious that we will have to rush up large number of troops at short notice whenever required, that is to say, that for operational reasons we will be forced to send up large numbers of unacclimatised troops to heights at short notice. Thus we are faced straightaway with the problems of acute mountain sickness. In our experience this physically incapicitates them for at least two to five days after arrival and affects their morale. It is of vital importance that they should be fighting fit when they get there. It is naturally our duty to find ways and means to prevent

acute mountain sickness or treat it effectively when it occurs. We know that when troops first go to high altitudes, they cannot march or work at the same pace as they did in the plains. However, their bodies gradually adapt to the changed conditions, and after a while they are able to perform more work, though they never reach their sea level efficiency. We know some of the changes which occur during this process of acclimatisation, but there is still much to be learnt to enable us to speed up this process, if possible, and to know the exact limitations imposed so that we may plan accordingly.

As our leaders have emphasised, we can never again trust the Chinese, so it will be necessary to maintain constant vigilance along our Himalayan border. Troops will, therefore, have to stay at high altitudes for long periods. This is our second problem.

We are, therefore, interested in being able to determine how long the process of adaptation will continue and whether these processes, if continued for a long time, can have any adverse effect, and whether we can find ways and means of overcoming these effects. Our next problem is the psychological effects of living at high altitude. The cold and hypoxia not only affect the physical functions of the body but combined with the rugged inhospitable terrain and the sense of loneliness and isolation induced by poor communications, affect the mental condition of troops in these areas. It is, therefore, important to be able to prevent a mental breakdown or have appropriate means, including drugs to relieve it, if and when it occurs.

Let us very briefly review the work carried out on these important problems so far throughout the world. I will make bold to say that this is almost a "virgin" subject and a vast field is open to anyone interested in these most absorbing problems. Previous work on most of these problems has been very limited and has been carried out mainly in the Peruvian Andes, the Alps and by the various mountaineering and scientific expeditions to the Himalayas. In Peru there is a base laboratory situated at sea level in Lima and a well equipped laboratory at Mococha at an altitude of 15,000 ft. The two laboratories are connected by road and rail and the trip takes only $3\frac{1}{2}$ hours. In contrast many of the investigations carried out by us at high altitudes in Ladakh often require the transport of subjects and specimens from low altitudes to high altitudes and vice versa. This is often hampered as the only means of communication is by air, which is frequently and unpredictably closed by bad weather.

In Switzerland there is a well equipped laboratory at Jungfraugoch at an altitude of 11333 feet, but as the majority of the population live at an altitude of 6000 ft. and below, there is hardly any research on human subjects carried out on high altitude pertaining to our problems. Recently, Brig. Inder Singh and Surg. Cdr. M. S. Malhotra attended an International Symposium on the problems of High Altitude at Interlaken (Switzerland) in October, 1962. Surg. Cdr. Malhotra also

visited the Institute of Andean Biology and High Altitude Laboratory in Peru in November, 1962. In the Himalayas, the well-known Himalayan Scientific & Mountaineering Expedition of 1960/61 led by Sir Edmund Hilary, carried out some pioneering work on these problems in which the observations were made on the members themselves who stayed for more than 6 weeks in the "Silver Hut" at about 18000 feet above sea level.

In India also very little work on this important subject was carried out before the Emergency. However, in January, 1962 the Armed Forces organised an International Symposium on problems of high altitude and although several countries including USA, USSR, UK, Japan, France and other countries participated in the Symposium, the only point this symposium high-lighted was that there is very little work done in the whole world on this subject and most of the work done so far was on animals and of a fundamental nature rather than applied. I have a few spare copies of the proceedings of the Symposium for those interested and I would be glad to send them a copy if they would drop me a line.

Since the Emergency the position has changed. As you know the first step to knowledge is "to know that we are ignorant". So the Armed Forces Medical Authorities listed all the problems of high altitude facing us and formed an Operational Medical Research Committee incorporating some of the civilian eminent research workers. From this list I decided that at least 50 projects had to be planned and completed as early as possible. 50 projects was a large number but in my opinion "Not failure but low aim is the crime". Some of the problems were immediately taken up by the Armed Forces laboratories including the R & D laboratories. The rest of the problems were sent to the Council of Scientific and Industrial Research, and the Indian Council of Medical Research, who in their turn distributed the problems to the various institutions, physiologists and other eminent research workers of our country. In the first part of this year some American physiologists including Dr. Davis came to our assistance to solve some of our problems.

In this Symposium we will attempt to tell you about some of the important problems tackled by these workers, including my several civilian colleagues to whom I am most grateful for the help. In this connection I cannot but help mentioning Prof. Anand, Prof. of Physiology and Prof. Sujoy Roy, Prof. of Cardiology of All India Institute of Medical Sciences. Dr. Anand has been my friend, philosopher and guide on almost all the problems of high altitude physiology undertaken by us. Hazards of working at high altitude are well known and it is easy to be brave from a distance. Dr. Sujoy Roy has himself faced the hazards of high altitude and carried out one of the most fascinating and important aspect of high altitude studies—Haemodynamic changes at high altitude including chronic mountain sickness. He has studied these changes in troops who were located for over 2 years

at 14,000 ft. He is now making a forward study on troops before and after inducting them at these heights.

Broadly speaking, so far our research projects have been directed mainly towards–

(a) Studying the effects of acute mountain sickness and trying to find ways and means of preventing it or treating it.

(b) The physiological changes which occur during acclimatisation and deacclimatisation with a view to determine the amount of effort that could be expected from troops at various stages of acclimatisation and the effects, if any, of prolonged stay at high altitude.

(c) The exact mechanism, prevention and treatment of pulmonary oedema.

(d) The most suitable clothes, food and shelter for troops living at high altitude.

(e) Methods of evaluating and increasing the physical efficiency of troops at high altitudes.

(f) Methods of measuring the degree of adaptation to cold and ways of enhancing cold acclimatisation.