THE DESCENT FROM MAKALU, 1961, AND SOME MEDICAL ASPECTS OF HIGH ALTITUDE CLIMBING

(Himalayan Scientific and Mountaineering Expedition, 1960–61)[1]

By MICHAEL WARD

I

On May 5, Gill and I finally found our way through to the Makalu Col. I found it a very tiring day and I was climbing slowly and with more effort than Gill. On the Col the wind was fierce and penetrating. We did not stay long, but came back slowly to Camp IV. Earlier that day we had put in fixed ropes and on the way down we were very glad of them. (During the next three days all the equipment and stores needed for the assault parties, including the bicycle ergometer, were brought up to the Col and dumped there.) On the 6th, we returned to Camp III feeling very tired but not completely exhausted. Next day I was surprised to find that Hillary, who had not been well for the past two days, thought that he should descend to Camp II. I knew that he had had a bad headache but thought that he would have got over it by this time. We descended to Camp II in the afternoon and settled in for a restful evening. The next day just after supper, as the sun was fading from the mountains, I heard a weak shout from Hillary's tent. I shouted over to him but there was no reply. I hurriedly pulled on my boots and went over to his tent in which he was sleeping alone. I found that he could not speak properly and had an obvious paralysis of the right side of his face. I immediately called to Jim Milledge, who was in a tent close by, and we rigged up an oxygen set within minutes. We gave Hillary oxygen throughout the rest of the night. I also gave Hillary a pain-killing drug as it was obvious that his headache was extremely bad. Milledge and I took turns to sit up for the remainder of the night in Hillary's tent to make sure that the oxygen tubes did not kink and that the cylinder did not run out. Within an hour or so the facial palsy had recovered although he still complained of severe headache in

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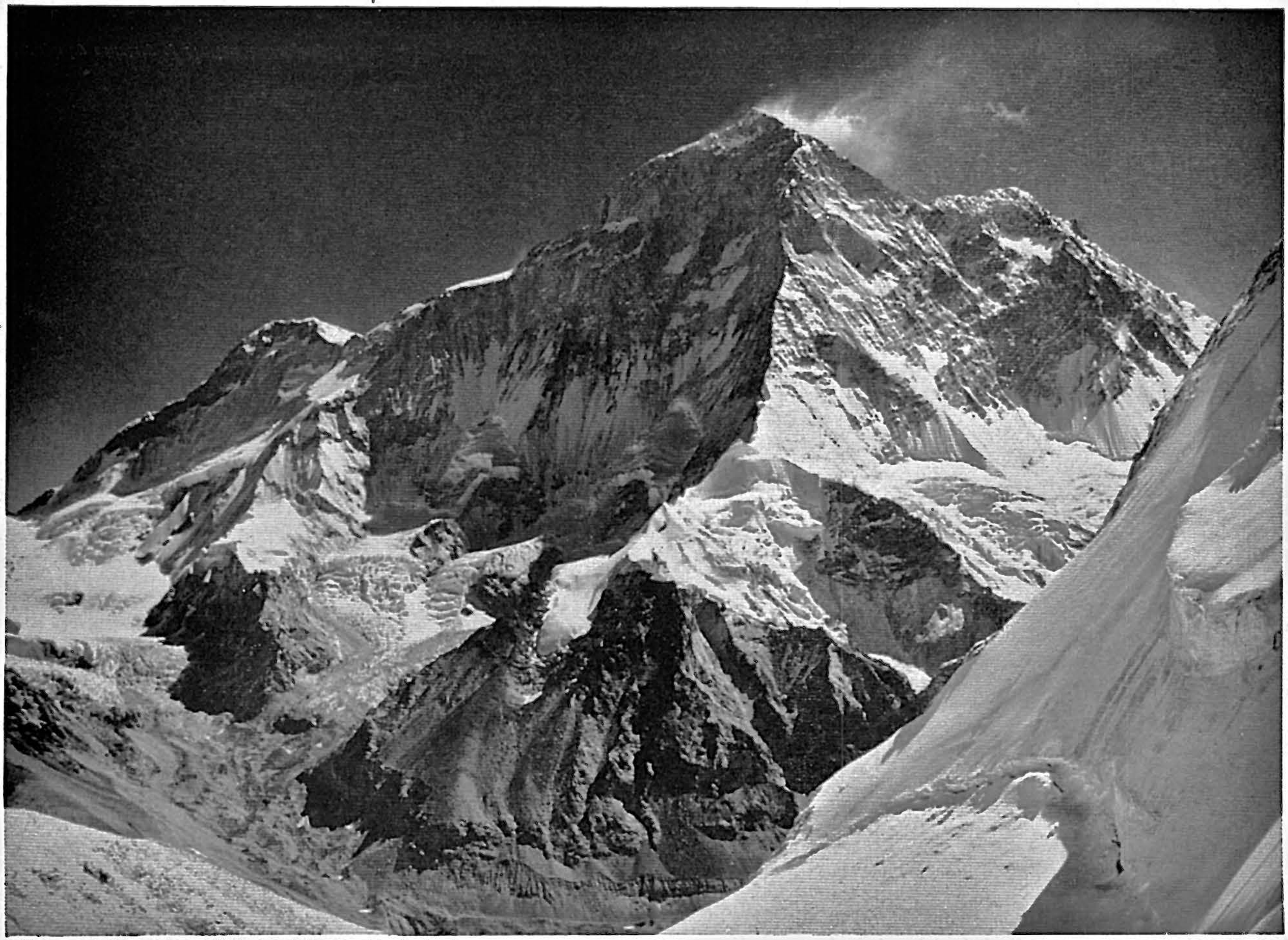

Photograph by courtesy of National Geographic Society]

MAKALU, WEST FACE. ARROWS INDICATE MAKALU COL.

To face p. 14

Photograph by courtesy of National Geographic Society]

SILVER HUT AND MEMBERS OF THE 1960–61 WINTER PARTY.

between bouts of sleeping. After an uncomfortable night Milledge and I decided that the best plan would be for Hillary to go down to Shershon and return to lower levels, if possible to Katmandu. I considered that he had had a transient stroke and it was for this reason that this course had to be followed. I thought he should be accompanied by a doctor and, as I was, in any case, the 'chef d'attaque' of the expedition, Milledge had this unenviable task whilst I took over the leadership from Hillary. Hillary and Milledge left the next day. Hillary was still aphasic and had a bad headache but could walk slowly. They took a wireless with them but communication was often bad and from then on we had little contact with this small party. I had one letter from Ed. In this letter he said that as he had so much at stake in the expedition, he would prefer not to return to Katmandu. He asked me to reconsider my decision to fly him out and to agree to his return to the school at Khumjung; he promised to stay below 15,000 ft. Hillary recovered gradually, and according to Milledge had slurred speech for about ten days. In his letter Hillary had proposed an assault plan—there were at the time no definite parties allocated for the assault. I had, however, made my own plan, which in fact differed but little from Hillary's.

I gave the news of Hillary's illness to Desmond Doig, who was stationed at the Silver Hut, and with whom we had radio contact. One great difficulty was that I had no idea where the stores were situated—and what equipment and food had been taken to the Col. However after I had seen Mulgrew on his return from seeing Hillary at Camp I, this problem was solved.

Despite the reduction in climbers I thought that if I took Milledge's place on the Makalu Col doing the physiological work with John West, we should still be able to complete our physiological programme as well as climb Makalu. Camp V on the Makalu Col was therefore established and John West and I started our work using the bicycle ergometer.

The first assault party, consisting of Romanes, Gill and Ortenburger, established Camp VI at about 25,800 ft. on the near side of the glacier coming down from the summit of Makalu. The following day, Gill and Romanes and Ortenburger started to cut steps across the glacier. This cost them a great effort in poor weather and, although they managed to get across the glacier and dump some material for the last camp, Camp VII, they could not establish this camp. On their return to Camp VI they had what might have been a nasty fall. The weather throughout these two days was cold with a severe and bitter wind. Gill's nose was very badly frost-bitten. Romanes too was in a very exhausted state when they returned to the Makalu Col and he had to have oxygen. They all three descended next day. It was obvious

that our plan would have to be changed, and accordingly I decided that Mulgrew and Nevison should establish Camp VII with Annalu and if possible push on next day to the summit, whilst Harrison, Urkien and myself would follow on after them. On May 16, Nevison, Mulgrew and Annalu and eight Sherpas set off from Camp V and spent that night at Camp VI. The next day they crossed the glacier.

The trail-breaking was left by and large to the Sherpas, in order to save Mulgrew and Nevison. On the way up the Sherpas had a fall and Ang Temba hurt his ankle. Both he and another Sherpa returned to Camp VI whilst Mulgrew took on an extra load of 22 lb. Nevison, from this point, did all the leading and step-cutting. They continued up slowly to Camp VII. There is no doubt that this unfortunate slip imposed a considerable strain on the assault trio.

After slow but steady progress a camp-site at the bottom of a rock-rib was reached. The height was about 27,000 ft.

The Sherpas left Mulgrew, Nevison and Annalu to make the site for Camp VII.

The next day, May 18, after a poor night the three of them set off for the summit. To start with, the wind was not bad, but higher up snow clouds were being driven from the summit ridge. They rose steadily, Annalu complained of a pain in his ribs but kept going. They thought that they would reach the summit and return by darkness. Suddenly Mulgrew got a terrifying pain in his chest and collapsed. For some time he could not move—he begged the other two to continue to the summit. Annalu too complained of the cold and said the pain in his chest was worse (he had probably cracked a rib in the accident the day before). There was only one decision for Nevison —and they started down. Mulgrew, helped by Nevison, crawled and slipped back to camp. Every now and again he had to stop to cough up dark red blood.

In the late afternoon they regained Camp VII. After a terrible night they set off next day. It soon became obvious that Mulgrew could not reach Camp VI that night. Annalu descended to get help— and in the afternoon two Sherpas arrived from Camp VI with a tent. In this Mulgrew and Nevison spent another terrible night.

In the meantime things had been going far from well lower down on the mountain. Romanes and Gill had descended to Camp III whilst West and I remained on the Col. It soon became obvious that I was not fit enough to take part in an assault, so when I heard that Ang Temba had injured his ankle I went up to Camp VI to spare Harrison and Ortenburger, the third assault party. (John West by this time had descended.) I climbed up to Camp VI using oxygen (May 18) and I looked at Ang Temba's ankle. He could not walk and would have to be carried down. I radioed to Harrison and Ortenburger, and next

day they came up again to Camp VI with Sherpas to carry Ang Temba off the mountain. I remember that when they arrived I thought for some reason that the assault party had succeeded. I told them this, much to their astonishment—this was in fact the first indication that I was becoming ill.

The Sherpas descended carrying Ang Temba, whilst I followed by myself, leaving Harrison and Ortenburger at Camp VI. As I descended the Sherpas gradually began to disappear into the mist and although carrying Ang Temba they were going faster than I was. At one point I felt most apprehensive as they disappeared from view into the clouds. It soon became obvious to me that I was going too slowly and was in fact in a bad way. By a great effort I managed to catch them up again. About a quarter of a mile short of Camp V, I fell off a small boss of ice and was almost unable to get up. I managed to shout to Urkien who came back with another Sherpa to help me. By hanging on to both of these Sherpas I got into camp. Here I had a tremendous fit of shivering and remember nothing for nearly 48 hours. My next recollection is of John West's face on May 22 as he came into the tent. He had in fact been down in Camp III and had come up again in charge of rescue operations. John and Tom Nevison helped me out of my sleeping bag and told me what had happened—I didn't understand them fully.

John West, Tom Nevison, some Sherpas and myself came down slowly—for myself this was an infinite effort of concentration. At the start of the long traverse to Camp IV, West left and went up again to the Col alone—this incidentally was the first big mountain on which he had climbed. I believe I may have protested about this, but I was too weak to force the issue. The descent took many hours and the fixed ropes were life-saving. Although fully clothed, I felt a terrible central coldness, all my fingers and toes were frost-bitten and my pace got slower and slower. As darkness fell I was still some hundred feet above Camp IV to which Nevison had descended to prepare a meal and warm sleeping bags. Two Sherpas supported me for all this time and I began to get hallucinations just before I arrived in camp. Tom forced some fluid, terramycin tablets and some stew down my throat. Evidently I was by now talking quite considerable nonsense in between using the oxygen set. I have a vivid memory of a dream concerning an underground house in Switzerland. Next day Mike Gill arrived at Camp IV and we set off, myself little better than before. By evening I had not reached Camp III but finally made it some time after dark.

The full enormity of the disaster that had overtaken us was by now apparent to me. I talked to Doig at the Silver Hut on the wireless. A disjointed and breathless conversation. Up on the Makalu Col the struggle to get Pete Mulgrew off continued. On May 20, after I had

left Harrison and Ortenburger at Camp VI, Annalu staggered into camp bringing news of Mulgrew's illness. Fortunately I had left a half-empty bottle of oxygen at Camp VI. Two Sherpas were sent up to Mulgrew and Nevison with this oxygen and a tent. Annalu continued down to Camp V with a note for me to send up more oxygen. On the 20th no contact could be made with me on the Makalu Col by wireless and as assistance from below was essential Harrison and Ortenburger tossed up with a hibitane pill who should descend. Harrison lost and came down. At Camp V he found me cyanosed, very breathless and I did not recognise him. The situation was now obviously desperate, with two ill men, one at 26,500 ft. and the other at 24,500 ft. In the meantime Ortenburger had climbed up to Mulgrew and Nevison. Nevison and a Sherpa descended to get help, whilst Ortenburger and Mulgrew, who was using oxygen brought up by some low-altitude Sherpas, managed to start down. Harrison, at the Makalu Col, radioed down to Camp III where Romanes and Gill were, to send up oxygen to the Col, which was by now almost denuded of personnel except for myself and one or two Sherpas. On the 21st, Mulgrew was brought down to Camp VI by some Sherpas who spent the night there without sleeping bags. On the 22nd, Urkien and some Sherpas appeared at Camp V on the Makalu Col without either Mulgrew or Ortenburger. Mulgrew was by now quite helpless, they told Harrison, but they were too heavily laden to bring him down. After a quick meal they set off again, and later in the evening brought in Mulgrew, by now delirious and, it appeared, almost lifeless. His hands were very badly frost-bitten. However, after some warm food and drink both Ortenburger and Mulgrew improved. On the 23rd, Ortenburger, after his extra-ordinary efforts in getting Mulgrew to Camp V, descended and late that evening some Sherpas arrived on the Col with oxygen. It was unfortunately nearly dark and Mulgrew had to spend yet another night at over 24,000 ft. On the 24th, West, Harrison and the Sherpas set off with Mulgrew from the Makalu Col. It soon became apparent that Mulgrew could not be carried and after a bit he became unconscious. The situation had once again become really desperate. However, Harrison made a makeshift sledge out of rucksack frames. This solution, life-saving as it turned out to be, worked extremely well. Mulgrew in a sleeping-bag, was strapped onto this vehicle and slid down the fixed ropes. Romanes and some Sherpas had in the meantime come up and were helping in the descent. The whole journey to Camp III was accomplished that day. I saw Mulgrew for the first time at Camp III and it was obvious that he should be evacuated as soon as possible. Arrangements had already been made to fly us out by helicopter from Shershon. Mulgrew was carried on the backs of relays of Sherpas. I walked down, as did Ang Temba. We arrived

at Shershon in the evening and next day the helicopter piloted by a Swede collected us, and took four of us, Mulgrew, West, who had come to look after us, Ang Temba and myself, in relays to the United Mission Hospital at Shantah Bhavan at Katmandu.

Mulgrew's life had been saved by quick thinking, devotion and extraordinary endurance on the part of many members of the Expedition under the direction of Ortenburger and Harrison. The Sherpas almost without exception were magnificent. Most of the Sherpas who helped to bring Mulgrew down were so-called 'low-altitude' Sherpas. They had some of them spent nights at Camp V and Camp VI without sleeping-bags or lilos. Urkien was of tremendous stature.

The effort, skill and teamwork needed to carry out this successful rescue was equal to any that would have been required to reach the summit. In addition there was the stress imposed by the very serious condition of Mulgrew. That he had managed to live through the nightmare days of his descent was unbelievable. His will to live had triumphed where that of a lesser man would have failed.

For the interest and information of those who climb high mountains I have written the following account of the adaptations of the human body to high altitude and made comments on the complications that can occur with especial reference to this expedition.

II

At sea-level the normal barometric pressure is equivalent to the weight of 760 mm. of mercury. As the climber ascends the weight of air decreases so that at 19,000 ft. it is equivalent to only 380 mm. of mercury. The percentage of oxygen in the air, however, remains the same whatever the height, i.e. 21 per cent.

Thus the amount of pressure driving oxygen from the lungs into the blood gets less the higher the climber ascends. It is this drop in pressure of oxygen that is the major factor in high altitude climbing. To combat this low pressure the body attempts to compensate with two major adaptive mechanisms.

In the first place more air, and therefore more oxygen, is passed through the lungs and secondly there is an increase in the number of red cells and, therefore, oxygen-carrying capacity of the blood. This enables the same amount of oxygen to be carried in the blood at 19,000 ft. as at sea-level. However, it must be rembered that the pressure of oxygen in the blood is very much less than it is at sea-level, therefore the maximum amount of oxygen that can be delivered to the tissues is very much less than at sea-level and the capacity for physical exercise is reduced.

The cells that are most sensitive to oxygen lack are those of the brain and this explains why accounts of climbing at high altitude are sometimes incomplete and bizarre. It explains, too, the hallucinations, forgetfulness and callousness that climbers often show when high on a mountain, which is quite unlike their sea-level behaviour.

These two main adaptive processes, namely the increase in breathing rate and increase in the number of red cells, may themselves cause medical complications and illness.

Increased breathing and the dry atmosphere at extreme altitudes increase the rate of water loss from the lungs by as much as three-fold. This is one reason why climbers tend to become dehydrated; other reasons are the difficulty of obtaining enough fluid from the snow because of limited fuel supplies and inefficient stoves, and the blunting of the sensation of thirst. Drying of the respiratory tract coupled with oxygen lack seems to predispose to respiratory infections, the most serious of which is pneumonia,

The increase in the number of red cells in the blood probably causes an increased liability to thrombosis. The normal ratio of red cells to plasma is 45 per cent red cells to 55 per cent plasma. At high altitude this ratio can change to 65 per cent red cells to 35 per cent plasma. The blood becomes very sticky and more difficult for the heart to push around the circulation.

Frost-bite is an almost inevitable sequela of illness or accident. Warmth depends on the flow of blood around the body. In any condition where there is 'shock', the peripheral blood vessels contract and the supply of heat to the limbs is greatly reduced or cut off. The extremities, therefore, cool down to the same temperature as the surrounding air which at extreme altitudes is below freezing and, no matter how much clothing is worn, frost-bite is inevitable.

Oxygen lack constricts the blood vessels of the lungs and causes a rise in pulmonary blood pressure. This increases the work on the right side of the heart and the heart enlarges. At high altitude, where the climber is continuously exposed to lack of oxygen, any lung condition which further impedes the absorption of oxygen is extremely dangerous. He may lose consciousness as an early symptom and signs of heart failure with pulmonary oedema may occur.

To examine the major illnesses that occurred on Makalu in the light of this knowledge is interesting and informative. To take my own case first; I developed a chest infection, probably at Camp VI (26,000 ft.) after a period of eight days on the Makalu Col doing work connected with our physiology programme, which involved maximum effort. This illness manifested itself in the first place by the hallucinations that I had at Camp VI followed by an inability to *descend* at a reasonable rate. I became progressively weaker and had to be dragged

into a tent on the Col. Here after rigor I became delirious—another manifestation of anoxia as the brain-cells are most sensitive to oxygen lack. I was treated with antibiotics and oxygen and descended 48 hours later with Nevison. On this descent I was occasionally delirious and felt a most extraordinary central coldness despite being fully clothed. I suffered frost-bite of all my fingers, toes and of my nose. The explanation here, I think, is that the lung infection, pneumonia (diagnosed by Nevison), strained an already strained heart and this resulted in a shutdown of the circulation. Blood, and therefore heat and oxygen, were not available for my peripheral vessels during the descent. My cardiac output was sufficient for lying in a sleeping bag but not sufficient for any form of exercise. This resulted in this feeling of central coldness, frost-bite and hallucinations. An X-ray of my chest at Katmandu, taken within 24 hours of returning by helicopter, showed an enlarged heart. Further X-rays at the London Hospital showed a gradual diminution in size of my heart until it became normal in size after three months.

In the case of Mulgrew the sequence of events was probably as follows: a clot of blood formed in his lungs at 27,000 ft. and this led to 'shock', constriction of his peripheral vessels and diminution in his cardiac output. This explains the coughing-up of blood, his complete collapse and his very severe frost-bite. After his evacuation to Katmandu, and to Australia and New Zealand, he developed an infection in his legs and had to have amputation of both of these below the knees as well as amputation of some of his fingers. The clot of blood in his lungs became infected and pus formed which had to be drained off.

Sir Edmund Hillary suffered what appeared to be a transient stroke. This may have been due to a spasm of his cerebral blood vessels secondary to a transient thrombosis. Three other cases with similar clinical features have occurred on expeditions to the Himalayas to fit, young personnel. Two of these patients subsequently died and one recovered. Nevison considered that he had had an attack of pulmonary oedema at Camp VI as his sputum was frothy and tinged with blood, he was also very breathless at rest. An X-ray taken in America some time later showed no cardiac enlargement.

If medical oxygen had not been taken on Makalu in all probability there would have been three deaths.

The precipitating factor in these three serious illnesses is not known, but I had just spent the winter at 19,000 ft. This had obviously taken more out of me than was generally thought at the time. In fact as a result of the winter, although the full programme of work was carried out satisfactorily, the general condition of the whole Wintering Party was less good than that of the party coming in during the spring. The

ascent of Ama Dablam with the subsequent carrying of a Sherpa off the mountain was a great strain, but I think I recovered from this. The subsequent month spent working often till after midnight at the Silver Hut tired the Wintering Party more than we realised. In fact, 19,000 ft. is too high for plainsmen to live at for long periods and 17,000 ft. or even 15,000 ft. is probably the best height to get maximum acclimatisation.

Hillary had spent one month in December and January on a round-the-world trip with the Yeti scalp after being with the expedition in the field from August to the end of November on the Yeti hunt. The scalp was flown in by him to Khumjung on January 5. He returned the same day and went back to New Zealand for a holiday and to organise the Spring Party. After he came back to the Silver Hut in March he had to return to Katmandu where he spent a week to ten days clearing up the difficulties arising from the ascent of Ama Dablam. In addition to being eight years older, his physical condition in 1961 did not compare with his superb fitness in 1953.

Mulgrew had spent the autumn on the Yeti hunt and had returned with the Spring Party. His general health appeared as good as that of any other member of the expedition.

The contrast between the physical condition of the climbers on this expedition and that of those on the French Expedition to Makalu, when all members (using oxygen) reached the summit, is quite remarkable. The same contrast was made between members of the successful Everest Expedition in 1953 (using oxygen) and the pre-war Everest Expeditions, the majority of whose climbers did not use oxygen.

The main effect of oxygen appears to be to combat deterioration and by doing this, and by increasing the speed of movement on the mountain, the climber can ascend more quickly, more efficiently and more safely than climbing without the aid of oxygen.

Oxygen should always be taken on all expeditions to Himalayan peaks, as it is of life-saving value in cases of acute pulmonary oedema and pneumonia. Both of these conditions can occur below 19,000 ft. and a serious case of pneumonia presenting as delirium occurred at 15,000 ft. on the present expedition in the earlier stages.

A supply of oxygen should always be present for emergency use *in all the high camps.*

Oxygen, too, should be used by climbers who are attempting to ascend peaks of over 24,000 ft., as it increases the margin of safety.

The question of oxygen for rescue operations must also be considered by the expedition leader.

One further point should be made: our stoves on Makalu did not work at all well, and the resulting deprivation of sufficient water may have played a part in the events high on the mountain.