

Caspari; and Loewy). The practical significance of this hemantic alteration, as viewed from an occupational standpoint, was restricted, until rather recent years, to permanent or transient inhabitants of regions of high altitudes (mountaineers, miners, and herdsmen) or an occasional balloonist. The rapid development which civil and military aviation has made lately exposes a constantly increasing number of individuals to the effects of high altitudes, and increases the general importance of this blood reaction (Koelsch and Lederer).

The symptomatic erythrocytosis observed as an effect of high altitudes may be divided according to the causative mechanisms into two types or phases. The sudden and rapid ascent to high altitudes, such as experienced by the personnel of airplanes and balloons, as well as mountain climbers, is followed during the first day by an increase in erythrocytes, which may be as much as twenty-six per cent of the original number (Kündig; Morawitz and Denecke; and Barcroft). The erythrocytosis thus observed is of the spurious type, since it is produced by distributory shifts of the blood cells into the peripheral vessels from the contracted spleen. The initial rapid increase is followed on subsequent days, provided the sojourn at high altitudes is prolonged, by a further rise in the number of erythrocytes. The peak of this process is attained when acclimatization has occurred, that is within one to three weeks (Culpepper; Meyer and Seyderhelm; and Barcroft).

The erythrocytosis of the second phase is characterized by an actual increase in the number of red cells, the concentration of hemoglobin, and the total blood volume (Zuntz; Liebesny; Laquer; and Henderson). There is an increase simultaneously in the oxygen capacity of the blood which, according to Talbott, averages 28 per cent at an elevation of 5,340 meters. While appreciable individual variations exist in the responsiveness of the erythropoietic tissue to changes in altitude, the magnitude of hematic alterations approximately parallels changes in the altitude. Bürker found that at an elevation of 2,000 meters the increase in erythrocytes varied (in different individuals) between four and twelve per cent, and that hemoglobin concentration increased between eight and eleven per cent. Schröder observed erythrocytic counts of 5.80 million at an altitude of 561 meters; Wolff reported counts of 5.97 million at an altitude of 700 meters; Kundig observed red cell counts of 6.55 million at 1,560 meters; Egger found 7.00 million cells at 1,800 meters; Viault reported 8.0 million erythrocytes in the Peruvians living at an altitude of 4,000 meters; and Laquer claimed that true polyglobulia begins with an altitude of 1,500 to 1,600 meters. There seems to be an upper limit to this erythrocytic increase with rising elevations, as Talbott reported that there was no difference in the oxygen capacity of the blood in individuals living at an altitude of 5,340 m and 6,140 m, respectively.

Since the erythrocytes and hemoglobin increase in about the same proportion, there is no change in the color index, according to Schneider and Havens.