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Low Alveolar Oxygen Pressure, Sodium Cyanide and the Carotid and Femoral Flow of Blood.

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Methods of study similar to those described in the preceding paper on the effects of variations in alveolar carbon dioxide were used.

The administration of low oxygen by either natural or artificial ventilation elicited an increased carotid flow of blood, followed by a decrease on re-administration of room air, and a decreased femoral flow, which increased on subsequent administration of room air. Variations from this response were slightly more common than variations with the administration of carbon dioxide. An initial decrease in carotid flow, preceding the increase, and a subsequent decrease in flow below normal, on re-administration of room air, were not infrequent. Changes in flow were more abrupt, and more fluctuating, than those produced by carbon dioxide. This peculiarity, however, was frequently missing. A response to low oxygen may be identical to a response to high carbon dioxide.

Intravenous injection of sodium cyanide produced a general increase in carotid flow of blood, and a decrease in femoral flow. An initial decrease in carotid flow preceded the increase.

When the mean blood pressure was maintained approximately constant by artificial regulation, the same directional changes in flow obtained.

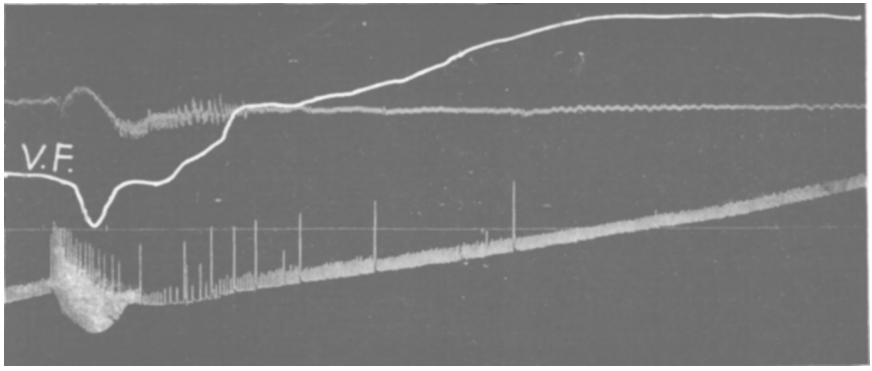

FIG. 1.

Record showing the effects of intravenous injection of sodium cyanide on mean blood pressure (above), carotid flow of blood and pulmonary ventilation (below).

The similarity of circulatory response to low oxygen and sodium cyanide suggests like chemical disturbances in and on the opposite sides of the neurone membranes of the circulatory centers involved in the regulation of circulation.

The inverse relation of carotid and femoral flows suggest again that circulatory adjustments occurred in favor of the brain.

Likewise, the similarity of the circulatory response to the administration of carbon dioxide on the one hand, and to the administration of low oxygen and sodium cyanide on the other, suggests common factors of control. Acidity and state of oxidation in and about the neurone membrane concerned may be the outstanding factors controlling circulation.

The high sensitivity of the circulatory and respiratory centers to changes in oxidation agrees again with their common and coördinated function.

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Tissue and Blood Acidity: Coördination of the Dual Function of Hemoglobin During Suspended Ventilation.

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In the paper directly following, on tissue acidity, blood acidity and pulmonary ventilation, we studied the problem of respiratory control, by regulating the shift of ions and acid molecules between the blood and tissues. A direct relation between pulmonary ventilation and blood acidity on the administration of carbon dioxide and sodium carbonate, and an inverse relation on the administration of sodium bicarbonate, were demonstrated. These diametrically opposite relationships were harmonized by referring these effects to changes in acidity of the respiratory center itself. Assuming that the acidity of the cerebro-spinal fluid reflected the changes in acidity of the respiratory center, our results agree with the theory that the acidity of the respiratory center is important in the control of pulmonary ventilation. For carbon dioxide turned the cerebro-spinal fluid acid, and increased ventilation; sodium carbonate turned it alkaline and decreased ventilation; and sodium bicarbonate turned it acid, and increased ventilation.

Changes which occur during suspended ventilation offer another