HEMOGLOBIN-RINGER, A NEW SUBSTITUTE FOR BLOOD IN MAMMALS[1]

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Ringer-Locke solutions containing dissolved hemoglobin may be substituted for normal blood in mammals. With the higher concentrations of hemoglobin (12 to 14 per cent) life may continue in cats for as long as 36 hours. The animals exhibit an essentially normal behavior for many hours.

Ultimately, they die because hemoglobin in solution slowly passes from the blood vessels into the urine and lymph, is taken up by cells of the reticulo-endothelial system, and is chemically changed into methemoglobin, which cannot function to transport oxygen. Hemoglobin loss cannot be prevented by removal of the kidneys. Death occurs when the oxyhemoglobin concentration has dropped to about 3 per cent; an acidosis develops before death.

In addition to transporting oxygen, hemoglobin in solution is able to supply a colloidal osmotic pressure which maintains an approximately normal fluid balance in all tissues except the kidney, where edema occurs associated with the elimination of much hemoglobin.

Blood volume may be directly determined with greater certainty than with other solutions by which the beat of the heart is not maintained.

The oxygen consumption of anaesthetized cats and dogs has been determined before and after the replacement of their blood with hemoglobin-Ringer solution. The results indicate that animals surviving on hemoglobin-Ringer have approximately the same oxygen usage as the previous normal.

Hemoglobin-Ringer has also been shown to be able to furnish sufficient oxygen for the use of the dog heart-lung preparation, which exhibits normal physiological responses for some hours. The solution leads to a somewhat quicker lung edema and dilation of the heart than is produced by dog's blood.

The experiments throw light upon the significance of the mammalian red blood corpuscles. These are important: (1) in maintaining hemoglobin in the reduced state, electrochemically speaking, and (2) in holding it within membranes impermeable to it so that it cannot leave the blood stream.

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