SOME MODEL RESULTS ON HEMOGLOBIN KINETICS AND ITS
RELATIONSHIP TO OXYGEN TRANSPORT IN BLOOD

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Introduction: In attempting the difficult process of constructing a mathematical model to represent transport of oxygen within the microcirculation, numerous simplifying assumptions are made to reduce the geometrical and physicochemical relationships to a mathematically tractable form. Any simplification which reduces the model's mathematical complexity carries with it the implicit requirement that this simplification is, in some sense, justified. There is, of course, a continuing need to reexamine the assumptions and the modeling process with each improvement in experimental data and/or change in the geometrical concepts of the microcirculation.

It is the purpose of the results presented here to critique a mathematical description of the oxygen-hemoglobin kinetics, and to quantitate, for the Krogh cylinder model, the effects of neglecting the dissociation velocity of oxygen bound to the hemoglobin of the red cells. As a natural extension of this examination, we also evaluate the possible effect and contribution of the position, or "shift", of the oxygen dissociation curve and its relationship to oxygen transport. The Krogh model concept of microcirculatory geometry, shown in Fig. 1, is well known and need not be developed here. See (1) and (2) for a detailed development.

A mathematical model which includes convective transport, oxygen-hemoglobin kinetics, capillary wall effects, and tissue space diffusion and consumption of oxygen has been given for this geometric model, (2), (3). It is described by the following:
Figure 1. The Krogh cylinder model of microcirculation.

Figure 2. Lethal corner concentration as a function of release velocity parameter $g$. 