TISSUE O₂ SUPPLY UNDER NORMAL AND PATHOLOGICAL CONDITIONS

M. Kessler¹, J. Höper¹, D.K. Harrison¹, K. Skolasinska¹, W.P. Klövekorn², F. Sebening², H.J. Volkholz¹, I. Beier³, C. Kernbach³, V. Rettig³, and H. Richter³

¹Institut für Physiologie und Kardiologie der Universität Erlangen-Nürnberg, Waldstr. 6, 8520 Erlangen, FRG
²Deutsches Herzzentrum, 8000 München, FRG
³Institut für Anästhesiologie der Universität Erlangen-Nürnberg, Waldstr. 6, 8520 Erlangen, FRG

INTRODUCTION

Systematic investigations of a variety of local parameters which form part of the complex functional chain responsible for delivery of oxygen to tissues revealed that most relevant information can be obtained by direct measurements of the oxygen tension field (Po₂ histogram) by means of Clark-type and Po₂ needle electrodes.

The special importance of local Po₂ results from the fact that we are measuring at the end of a long transport chain, linked to the energy producing system of the cell by the intracellular flux of oxygen molecules. This diffusion flux is determined by the local Po₂ gradients between the capillaries and the oxygen consuming enzymes in the cells.

Investigations of spatial Po₂ fields in tissues of various organs (see Kessler et al., 1973) have demonstrated that, under physiological conditions, two types of Po₂ histograms exist in the tissues. The first type of Po₂ distribution curve found in brain (Skolasinska et al., this volume), liver (Görnandt et al., 1973), and skeletal muscle (Harrison et al., this volume) (Fig. 1) is characterized by the fact that the lowest Po₂ values approach 1 to 2 Torr and that the modes lie within a Po₂ range of 15 - 30 Torr. The second type of Po₂ histogram which is found in the lung (Volkholz et al., this volume), the heart (Kessler et al., this volume) and the
outer cortex of the kidney (Sinagowitz, 1977) shows a distinct shift of the distribution curves to the right with the lowest $P_O_2$ values much higher than 1 - 2 Torr (Fig. 2).

The fact that the $P_O_2$ histograms have a very similar configuration in all organs with the exception of lung, heart and outer cortex of the kidney (Sinagowitz, 1977) shows a distinct shift of the distribution curves to the right with the lowest $P_O_2$ values much higher than 1 - 2 Torr (Fig. 2).

![Fig. 1. $P_O_2$ histograms of skeletal muscle, liver and brain.](image)

![Fig. 2. $P_O_2$ histograms of kidney, heart and lung.](image)