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Interrelationship between oxygen consumption, superoxide anion and hydrogen peroxide formation in phagocytosing guinea pig polymorphonuclear leucocytes.

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The paper presents an experimental procedure for a simultaneous assay of oxygen consumption, O2- release and H2O2 accumulation at a very early stage of the respiratory burst that is induced by phagocytosis in guinea pig polymorphonuclear leucocytes. The main findings are as follows: (a) The oxygen consumption that is measurable does not correspond to all oxygen that is reduced. The relationship between the actual oxygen consumed and the amount that is reduced depends on the fate of the intermediate products O2- and H2O2. (b) O2- is measurable extracellularly by the reduction of cytochrome c. When cytochrome c oxidizes the extracellular O2-, molecular oxygen is formed. This fact is shown by a decrease of oxygen consumption. The molar ratio between the O2- detected and the oxygen given back is 1. (c) The amount of O2- released from the cells accounts for only a small part of oxygen actually reduced. (d) H2O2 is detectable only in the presence of NaN3. In this condition almost all oxygen consumed is recovered in the form of H2O2. The molar ratio O2/H2O2 is near unity. The amount of H2O2 derived from dismutation of O2- released is only an aliquot of the total H2O2 accumulated. Thus, most of H2O2 is derived from intracellular sources. (e) In the absence of inhibitors of H2O2 degrading reactions, no detectable accumulation of peroxide occurs. Under these conditions, the main part of H2O2 formed is degraded in almost equal amount by catalase and myeloperoxidase, while only a small aliquot is degraded by NaN3 insensitive reactions.

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