the oxidase portion of the respiratory system it may be concluded that such huge doses of sodium cyanide inhibit the aerobic processes depending on heavy metal catalysis. The survival period of cyanide is practically the same as that observed in nitrogen. Experiments on excised cerebral tissue of infant and adult rats disclose that N/200 sodium cyanide inhibits 95% of the total oxygen consumption.

Iodoacetic acid, 1 mg, was injected simultaneously in other infant rats. After allowing 15 minutes for absorption half of the total number of injected rats were placed in an atmosphere of nitrogen and the other half retained as controls respiring air. The infant rats which received iodoacetate and were placed in an atmosphere of nitrogen exhibited a survival time of only 3 minutes. Adult animals in nitrogen survived for the same short period. The injected infants breathing air lived for 50 minutes (the duration of the experiment). It seems, therefore, that the inhibition of glycolysis by iodoacetate removes the source of energy which permits prolonged survival in the young. It has been repeatedly demonstrated that the iodoacetic acid inhibits the change from triosephosphoric to phosphoglyceric acid in the anaerobic cleavage of glucose.

*Summary.* The prolonged survival period of infant rats, despite inhibition of the cytochrome-oxidase system with sodium cyanide, demonstrates the function of an anaerobic source of energy. The rapid death after the injection of iodoacetic acid and exposure to an atmosphere of nitrogen suggests the anaerobic conversion of carbohydrate to lactic acid as the source of this energy.

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## Oxygen Saturation of Arterial Blood in Jaundice Complicating Lobar Pneumonia.*

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Jaundice in varying degree was a reasonably common complication of lobar pneumonia in the pre-sulfonamide era. It was usually accorded serious prognostic import, since the mortality was

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far greater than in the non-jaundiced cases. Many theories have been advanced to explain this jaundice in lobar pneumonia. Some are obviously untenable, while others appear plausible, because they are supported by experimental data. It has been attributed by various authors to an associated gastroduodenitis, to disturbed intrahepatic circulation, to the breakdown of hemoglobin during red hepatization of the lung, and to the presence in the liver of an hemolytic diplococcus. All these theories have proved inadequate.

Examination of autopsy material occasionally revealed parenchymal degeneration of greater or lesser extent. A more frequent finding was cholangiolitis. Both of these histologic findings seemed inadequate to explain the icterus, especially since they were observed in non-icteric cases as well. Klemperer and Gerber,[1] reviewing the pathologic findings in the liver in cases of lobar pneumonia, failed to find cholangiolitis consistently enough to attribute the jaundice to it alone.

The observation has repeatedly been made that in severe anemias, such as pernicious anemia, with consequent tissue anoxia, the liver may manifest central necrosis of varying extent with associated disturbance of function. Rich[2] demonstrated that rats placed in low-oxygen-tension chambers develop a diminished ability to excrete intravenously injected bilirubin, and that the livers of these animals show degeneration of cells in the region of the central veins. He proposed the theory that the anoxemia in lobar pneumonia, by its detrimental effect on the liver, renders this organ less efficient in the excretion of circulating bilirubin, which is frequently increased. This combination of hyperbilirubinemia and impaired ability of a liver, damaged by anoxia, to excrete the pigment effectively would seem to constitute the essence of the pathological physiology of jaundice complicating lobar pneumonia.

Twenty-nine cases of lobar pneumonia of various types were studied. Brachial artery punctures were performed and determinations were made of the oxygen content, capacity and percentage saturation of the arterial blood by the method of Van Slyke and Neill.[3] Immediately following the arterial punctures, bilirubin excretion tests were performed according to the technic of Eilbott,[4] as modified by Soffer and Paulson.[5] In this manner the initial blood

1 Klemperer, P., and Gerber, I., personal communication.

2 Rich, A. R., *Bull. Johns Hopkins Hosp.*, 1930, **47**, 338.

3 Van Slyke, D. D., and Neill, J. M., *J. Biol. Chem.*, 1924, **61**, 523.

4 Eilbott, W., *Z. f. klin. Med.*, 1927, **106**, 529.

5 Soffer, L. J., and Paulson, M., *Am. J. Med. Sci.*, 1936, **192**, 535.

level was determined, as well as the percentage retention, 4 hours after the intravenous administration of a predetermined amount of the bilirubin. Five percent retention of bilirubin after 4 hours was considered the upper limit of normal. Notation was made of the sputum type, the presence or absence of positive blood cultures, the hemoglobin at the time of the blood determinations, and of such pertinent therapy as might conceivably affect the data. In instances of jaundice, the bilirubin excretion test was omitted because of its unreliability.

There was no obvious correlation between the degree of anoxemia and the ability of the liver to excrete intravenously injected bilirubin. One case, the most anoxemic in the series, with an arterial blood oxygen saturation of only 73.5% showed no bilirubin retention. Another, with an oxygen saturation of 85.4% showed a retention of 5.8% which represents the slightest impairment, the figure being very close to the upper limit of normal. On the other hand, in another case, in which only moderate anoxemia obtained, the arterial saturation being 88.3%, there was a bilirubin retention of 15.4%. Still another, which had a bilirubin retention of 10%, had a normal oxygen saturation of 95.4%. A case showing marked bilirubin retention (12.1%) had only moderate oxygen unsaturation (90.1%). Other cases with impaired bilirubin excretion, less marked than those mentioned above showed little or no oxygen unsaturation; conversely, cases with more marked anoxemia showed little or no impairment of bilirubin excretion. Trend graphs, with the figures for both oxygen content as well as percentage saturation, plotted against blood bilirubin and bilirubin retention, showed no apparent relationship between these variables.

Many of the patients had received initial doses of sulfapyridine before the tests were performed. On the basis of experience with the action of this drug, it is believed unlikely that the blood determinations were at all influenced by these small initial doses of sulfapyridine.

*Summary.* (1) Twenty-nine cases of lobar pneumonia were studied with a view to determining any relationship between anoxemia and jaundice in this disease. (2) No obvious relationship could be demonstrated between anoxemia and the presence of jaundice or disturbed liver function as determined by the bilirubin excretion test.