

ficial circulation may be checked up and variations in blood pressure may be anticipated.

CONCLUSIONS.

The need of a simple clinical measure of cyanosis has long been felt, not only by surgeons and anæsthetists, but by physicians who have under their care pulmonary and cardiac cases.

It is contended that sub-oxydation or oxygen unsaturation of the total circulating blood is abnormal and imperils the life of the patient.

There appears to be a large unexplored field in the physiological limits of oxygen unsaturation. This field includes obstetrics.

By simple laboratory methods the two extremes of complete cyanosis and complete oxygenation have been secured.

The exact color value of these extremes has been permanently recorded by the help of the Munsell system of color notation.

Intermediate gradations of these extremes have been secured by mechanical means, so that a scale is available.

The resulting scale, the hæmoxometer (oxyhæmoglobino-meter) is a positive basic measure of the oxyhæmoglobin content of the blood under observation. The opacity presented by the finger nail and mucous membrane has been studied and closely duplicated.

The hæmoxometer is offered as a simple clinical measure of oxygen unsaturation (cyanosis), *basically correct*, in practice, *approximate*.

In submitting this original device, the writer is convinced that it has a sphere of usefulness scarcely second to that of the hæmoglobinometer.

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Allergy to cow's milk in infants with severe malnutrition.

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There is much evidence to indicate that under certain conditions the intestinal tract of infants is permeable to slightly altered or unaltered protein.

This has been demonstrated to be true of egg protein by Lust, Hyashi, Schloss and Worthen and others and for the proteins of cow's milk by Modigliani and Benini and Schloss and Worthen. These investigations were based on the demonstration of the protein in the blood or urine by means of precipitin tests or anaphylactic tests on guinea pigs. Such passage of unaltered or partially digested protein is especially apt to occur in malnourished infants or in those suffering from diarrhea.

The investigations cited all show the possibility of foreign protein entering the blood stream through the intestinal wall. If this were a frequent occurrence it would seem of interest to determine whether the entrance of foreign protein under these conditions provoked the production of antibodies. This question is probably of more than academic importance. Moro found precipitines to cow's milk in the blood of 2 out of 24 atrophic infants examined post mortem. Bauer demonstrated precipitines in the blood of 4 atrophic infants.

During the past two years we have conducted investigations on infants with nutritional disorders to determine the frequency with which antibodies to milk occur in the blood.

Precipitin tests for antibody were done as follows: To 1 c.c. of milk dilutions of 1-100, 1-500 and 1-1000 was added 0.1 c.c. of the serum to be tested. The tests were read after incubation for 1 hour at 37.5° C, the tubes were then kept on ice for 24 hours and read a second time.

In the earlier tests controls of normal human serum and normal rabbit or sheep serum were used. These tests were uniformly negative and were omitted in the later tests. Positive controls were made by using anti-milk rabbit serum. Breast milk in similar dilutions to the cow's milk was used as a control in some of the tests. Control tests, using the serum from the patient investigated diluted with normal saline, were used throughout.

The tests for anaphylactic antibody were conducted as follows: Three c.c. of citrated blood were injected into the peritoneal cavity of a 200 to 300 gram guinea pig. Twenty-four hours later 0.5 to 0.75 c.c. of fat free milk were injected intravenously.

Tests for antigen were made by adding 0.1 c.c of anti-milk rabbit serum too .1 c.c. of the serum to be tested diluted to 1 c.c. with normal saline solution.

The following control tests were used :

(1) One-tenth c.c. of the serum tested was diluted to 1 c.c. with normal saline.

(2) One-tenth c.c. of the anti-serum was diluted to 1 c.c. with saline.

(3) One-tenth c.c. of normal rabbit serum was added to 0.1 c.c. of the serum tested diluted to 1 c.c. with saline.

(4) One-tenth c.c. of normal human serum was diluted to 1 c.c. with normal saline solution and 0.1 c.c. of the anti-milk serum added.

The controls were uniformly negative and all were not used in each series of tests. In the later tests only 1 and 2 were used.

The anaphylactic tests for antigen were made by injecting 3 c.c. of the citrated blood into the peritoneal cavity of a 200 to 300 gram guinea pig. Three weeks later an intoxicating dose of 0.5 to 0.75 c.c. of milk was injected intravenously.

Observations were conducted on 37 patients with athrepsia and in 24 the precipitine tests were positive on at least one occasion. In many cases the test was repeated from one to eight times.

In 13 of the cases with positive precipitine tests the attempt was made passively to sensitize guinea pigs by injections of the patients' blood. The results were positive in 8 cases. The results were considered positive only when the animals developed very severe symptoms. When the symptoms were slight or open to any question the experiment was considered negative or was excluded. In the tests considered positive the animals developed marked dyspnea, convulsive movements or paralysis and in most instances died within 15 minutes after the injection. The necropsies disclosed marked distension of the lungs.

Throughout the investigation many control tests were made. Intravenous injections of milk in the quantities used caused no symptoms in normal guinea pigs. All of the positive experiments on animals were in cases in which the blood showed precipitines for cow's milk. In no instance did the blood of infants not showing precipitines for cow's milk passively sensitize guinea

pigs to cow's milk. In 33 cases with negative precipitine tests attempts passively to sensitize guinea pigs with the patient's blood were negative.

In a number of the patients observations were made over a period of from 2 to 4 months. It was found that the presence of precipitines varied from time to time. Thus far our observations have been too few to correlate the presence or absence of precipitines with the clinical condition of the patient. In four patients, however, who were observed over a long period, the precipitine reaction was absent during periods when the infant was losing weight or when the weight was stationary and reappeared when the patient improved. With further improvement the precipitines disappeared entirely. This question, however, must be studied further before any conclusions can be drawn.

A group of 30 infants suffering from a mild or moderate grade of malnutrition or convalescent from acute infections were studied. In 25 cases the tests for precipitines to cow's milk were negative and in 5 positive. In two of the positive cases passive sensitization tests on guinea pigs were tried. Both were positive. Fifteen tests on older children or adults were negative. The blood of eleven new born infants (placental blood) was examined and was negative in all.

Tests for milk protein in the blood were made in 27 cases of severe diarrhea by the precipitine reaction and also by anaphylactic tests on guinea pigs. All of the patients were receiving cow's milk as food. In six cases the precipitine test was positive. In 17 cases the anaphylactic tests on guinea pigs were positive. In 10 control tests on athreptic infants both the precipitine and anaphylactic tests for antigen were negative. These results confirm the work of Lust, Schloss, and Worthen, and others, in showing that in diarrhea there is a tendency for the intestinal tract to be permeable to protein. In this connection tests for precipitine to cow's milk on 13 infants suffering from diarrhea or convalescent from diarrhea are of interest. In all of these cases precipitine was present. Passive sensitization tests on guinea pigs were made in 8 cases and were positive in 3.

These observations seem to indicate that the blood of athreptic infants may show the presence of reaction bodies to cow's milk both by the presence of a precipitine to cow's milk protein and by the fact that the blood of the infant can passively sensitize guinea pigs to cow's milk.

Whether the presence of these reaction bodies bears a causative relation to the clinical condition we do not feel in a position to discuss with assurance at the present time. That this may be true seems quite possible and is in accord with many clinical observations. On the other hand, the presence in the blood of athreptic infants of reaction bodies to cow's milk protein may be due merely to the fact that the intestinal tract of such infants has permitted the passage of cow's milk protein into the blood stream, thereby causing antibody formation, and may not be of etiological importance. Observations are being conducted at present which may throw some light on this question.

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Carbon assimilation and respiration of autotrophic bacteria¹

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The autotrophic bacteria, or those bacteria which are capable of assimilating carbon dioxide chemosynthetically utilizing for that purpose the energy obtained from the oxidation of simple inorganic substances, range from obligate to facultative forms. In other words they range from those which are capable of obtaining their energy only from the oxidation of specific inorganic substances but from no other source to those that can exist autotrophically and heterotrophically; the latter can obtain their energy both from inorganic sources and, lacking these, also from the oxidation of organic compounds. The nitrite, nitrate and certain sulfur bacteria are the only strict autotrophic forms, while all the others, including various sulfur bacteria,

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