THE ANAEMIAS

BY

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To begin with, it will be useful to give a clear definition of that often misunderstood, and misinterpreted term 'Anaemia'. A very correct one, indeed, is the one given recently by Dr. Dyke, who defines Anaemia 'as a deficiency of the haemoglobin content, or of the red corpuscles, or of both'. In order therefore to get a clear understanding of the subject 'Anaemia', one does well to first go through the physiology of the red blood cells, and the haemoglobin.

The total volume of blood in any individual is roughly about one-eleventh of his body-weight. Of this volume, the cells constitute about 40 per cent, the remainder being plasma. The volume of the blood practically remains constant at rest, but with excitement, and exertion by the contraction of the spleen, which is considered to act as the reservoir of the blood—this is increased. In Anaemias, the blood volume is moderately diminished. The red blood cells are biconcave discs, their size and shape being adapted to the carriage of haemoglobin, and the supply of oxygen to the tissues. The blood of a normal, healthy man averages about five and a half millions of red cells per c.m.m., and 15 grams of haemoglobin per 100 c.cm.; of a normal, healthy woman about four and three-quarter millions of red cells per c.mm. and 13-14 grams of haemoglobin per 100 c.cm. The colour index measures the average amount of haemoglobin contained in the red corpuscles of a sample of blood, and is usually arrived at from the amount of haemoglobin per cent, divided by the number of red cells per cent of the normal.

The red cells in any smear of blood are never always identically equal, but are inclined to show a varying size, or what in laboratory terms is expressed by the term 'anisocytosis'. In Anaemia, this variability is accentuated, and can be of diagnostic significance. Red cells which are definitely larger than the normal ones are termed 'megaloblasts', whereas the smaller ones are 'microcytes'.

The bone marrow is responsible for the formation of the red cells —the earliest forms of which are known as the megaloblasts. When these divide, they give rise to the normoblasts, which are smaller cells, with round, deeply-stained nuclei, very rich in haemoglobin. These cells lose their nuclei by extrusion or solution, and on account of their basophil cytoplasm, are known as reticulocytes, or immature red cells. The normal reticulocyte count is $\frac{1}{2}$ to 2 per cent.

The adult red blood cell is a lifeless haemoglobin container, and by the buffeting it receives in the circulating blood, it gets worn out. As it ages it becomes malformed, and finally broken up into fragments which are engulfed by the phagocytic cells of the liver, spleen and tissues. These malformed cells are known as 'poikilocytes'. In all forms of Anaemia, the red cells are less perfect than in health, and

poikilocytosis rapidly develops. For this reason it becomes necessary to keep all patients suffering from Anaemia in bed, to combat the circulatory wear-and-tear.

The pigment haemoglobin is the oxygen carrier. In the lungs the haemoglobin combines with the oxygen of the air, and forms a loose compound of a bright scarlet colour called 'oxyhaemoglobin'. The oxygenated blood is taken to the heart and thence propelled through the arteries all over the body, where the tissues take the respiratory oxygen from the oxyhaemoglobin, and this removal of oxygen changes the colour of the blood to the darker tint seen in the veins.

'Anaemia' is a most fashionable diagnosis made among the lay public, more so among the fairer sex. The colour of the face, less so now than ever before, gives very little indication of the state of the blood; and the tint of the lips, and finger nails is of still less value, perhaps even misleading! The colour of the conjunctivae can help, and that of the gums, and mucous membrane of the mouth too; or as Dr. Dyke maintains 'probably the safest purely clinical guide is the colour of the palm of the hand as compared with that of the observer'.

The old order of classification has changed, yielding place to a newer, and a better one. The hitherto recognized grouping of Anaemias into 'primary' and 'secondary' has been changed to one based on etiological or morphological lines.

A good working classification would be as follows :—

1. Anaemias due to the loss of the red cells, i.e., haemorrhage and haemolysis.
2. Those due to deficient formation of the red blood cells.

As examples of class 2, Pernicious Anaemia and Anaemia of sprue may be taken. In both these diseases, where the quantity of haemoglobin remains unaffected the colour-index consequently is higher than normal, even reaching as high as 1.8. Here we get a marked shortage of red cells, due to defective haemopoiesis.

In Chlorosis, Anaemia of Pregnancy, and Anaemias of Infancy, there is no shortage of red cells, but there is a deficiency of haemoglobin—and hence the colour index is low—sometimes as low as 0.3.

Referring once again to Dr. Dyke's admirable article on Anaemia, we come to the factors necessary for the normal formation of red cells, and their relation to the various forms of Anaemia. Iron has long been known as a very valuable blood-forming factor, and of recent years copper, manganese, and still more recently, Vitamins B and C have also been added to the list. Another factor, aptly termed the 'anti-anaemic' has quite recently been found out. These factors are : (1) extrinsic, i.e., those that come from our food, water, etc.; (2) intrinsic, those that our system provides.

The minerals and vitamins are the more common extrinsic ones, while the anti-anaemic factor is of the intrinsic kind, and is known, on account of the fact that its absence causes Pernicious Anaemia as the 'P.A.' factor. The P.A. factor is found to be present in all normal gastric juice and is stored up in the liver, its main function being to expedite the maturation of the immature red cells. If this factor is lacking, the red cells in the bone marrow remain immature and do not

come into the circulation or if they do, they are speedily killed out. This explains quite rationally how efficaciously liver-extract acts in Pernicious Anaemia.

For a diagnosis of Anaemia to be made, the following tests are done :—

1. The enumeration of the red cells, the number of which is very low in Pernicious Anaemia, Sprue-Anaemia, Anaemia of Kala-Azar and Malaria, 'Bengal spleen', etc.

2. Estimation of the Haemoglobin percentage, which is low in Anaemias, most so in Chlorosis, Anaemia of Pregnancy, Anaemia of Infancy, Ankylostomiasis, etc.

3. Calculation of the colour index, high in Pernicious Anaemia, Sprue-Anaemia—low in Chlorosis, etc.

4. Presence in blood-films of Anisocytosis, Megaloblasts, Microcytes, etc.

5. Vanden Berg's test, which is usually positive in P.A.

Intensive liver treatment is now carried out in most forms of Anaemia—the best results, of course, being seen in Pernicious Anaemia; in fact, response to liver treatment confirms the diagnosis of P.A. The liver preparations must contain the P.A. factor, and the earliest recognisable phenomenon is the liberation into the blood stream in a few days of numbers of immature red cells, known as 'reticulocytes', which mark the beginning of the improvement in the disease. If the patient cannot take the liver-extract by mouth it is given in concentrated form by injections, in such preparations as, the better known ones being, Campolon, Hepatex, etc.

In the Anaemia of Sprue, the P.A. factor is also involved : here it is not so much by its absence, as Dr. Dyke points out, but by its failure to be absorbed from the bowel. But liver treatment is not the panacea here; calcium must also be given.

In the Anaemias due to deficiency of haemoglobin, liver-extract is a help, but the exhibition of iron is the main need and is now given in the form of Iron Ammonium Citrate.

In conclusion, acknowledgment must be made for extracts taken from that admirable paper of Dr. S. C. Dyke, D.M. (Oxon.), F.R.C.P. (London), which appeared in the *Lancet*, 13th October, 1934; also to Bayer, *Records*, Vol. ii, January 1935.

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