A FEW FACTS ABOUT BLOOD

The human body is the most complex organism on the face of the earth. The vast accumulation of knowledge pertaining to the human body, its anatomy, and the functions of the different organs is far more than one man can master, consequently the medical profession has been advancing more and more toward specialization.

It is hoped that this essay will give the reader some conception of the enormous complexity of the human body. This essay will deal with blood, but wait. . .not with all the particular structures of the blood. That would take at least a good-sized volume. It will deal with Red Blood Corpuscles, and as it is, this small collection of facts would be very inadequate for its complete study.

The importance of blood in fighting the war is being brought before our minds every day. Workers, housewives, and students are flocking to Blood Donors Clinics to give some of life's precious fluid that soldiers and civlians on the war fronts may live. Therefore, we will look into this matter. We will delve into its structure and learn a little about this wonderful, scarlet, flowing tissue so important to life.

Red blood corpuscles are present in the blood of a animals. In man they are biconcave in shape and measure 0077 mm. in diameter. About 5,000,000 are present per c. mm. in man and in a woman the average number is about 4,500,000. Looking at a drop of blood under a microscope we see that its color appears to be a faint pink, but when it is seen in a mass it takes on the familiar blood red color, varying from the bright red found in arterial blood to the bluish red found in venous blood. This difference in color is due to the amount of oxygen combined with the hemoglobin in the red blood corpuscles. The purpose of the red blood corpuscles is to carry oxygen from the lungs to all the body tissues. They are capable of doing this because they contain hemoglobin, that substance which has the property of combining easily with oxygen. Hemoglobin is, therefore, the most important constituent of the red blood corpuscles, making up about 32% of its weight.

Red blood corpuscles are composed of stroma, hemoglobin together with water, salts and a certain amount of lecithin and cholesterol. The stroma is a soft spongy substance which gives shape to the corpuscles and forms a spongy network on which the hemoglobin is deposited. Another opinion is that the corpuscles are tiny containers with a covering of lecithin and cholesterol and that the hemoglobin is found within.

Lecithin, a fatty substance containing phosphorus, and cholesterol, a solid alcohol, compose 30% of the dry weight of the stroma, that is, the weight of the corpuscles after the hemoglobin has been removed. Lecithin and cholesterol are important to the corpuscles in that they have to do with their permeability. They are permeable to water and other solutions, but impermeable to potassium and sodium ions. The concentration of these ions is far greater in the blood plasma than in the corpuscles.

Hemoglobin is not in solution in the red blood corpuscles, nor is it deposited as crystals, therefore the conclusion is drawn that it is present in the amorphous form. Hemoglobin may be forced out of the blood into the blood plasma. When this occurs the blood changes color, be. coming a dark crimson. This is known as laked blood.

Hemoglobin is a chromoprotein. That is, it is a protein plus a pigment. As already stated, hemoglobin has as its chief property the ability of uniting readily with oxygen. However, it exists in either the oxidized or reduced state, and it is important to realize that the compound of hemoglobin and oxygen (oxyhemoglobin) is a very loose one and the oxygen separates from the hemoglobin when the sorrounding oxygen pressure is reduced. Save for this property, it is easily understood that hemoglobin could not serve as oxygen-carrier in the blood.

Hemoglobin is found in the blood of all mammalia and even in the blood of lower forms. It has the enormous molecular weight of 16,669, its formula being C758 H1203N195S3FeO218. Recently it has been stated that the molecule of hemoglobin has 4 atoms of iron. If this is the case the above molecular weight would be multiplied by 4 and would be approximately 83,000.

In the average man there are 14 grams of hemog-

lobin to every 100 grams of blood and in an individual who weighed 68 kilograms (150 lbs.) there would be 500 to 700 grams of hemoglobin divided up among 25,000,000,000 corpuscles, which would give an area of 3200 sq. meters. This area is almost completely utilized by the body. The capillaries are so fine in the lungs that the corpuscles have to pass through them in Indian file, as it were, and every corpuscle comes in contact with the oxygen. Instruments, known as hemometers, are in use which enable technicians to ascertain the hemoglobin content of the blood by the colorimetric method with a drop or two of the person's blood, obtained by pricking the finger.

Red blood corpuscles are without nuclei; a fundamental part of any living cell, therefore, a red corpuscle cannot live very long in the blood stream. It is known that bile pigments are made up of hemoglobin, thus it is fairly certain that the red blood corpuscles are steadily undergoing destruction and the length of their utility is generally supposed to be from 2 to 4 weeks.

As the red blood corpuscles are being continually broken down it naturally follows that new ones are being continually furnished. It has been proved beyond a doubt that in adults the red blood corpuscles are manufactured in the marrow of the long bones. This manufacture of red blood corpuscles is known as hematopoiesis and is greatly augmented after the loss of a considerable amount of blood. The red blood corpuscles originates as colorless cells containing nuclei and at this stage of their development they are called erythroblasts. As these cells multiply their cytoplasm adds hemoglobin, and finally the nucleus is extruded and a red blood corpuscle is the result. If the body suddenly becomes in need of a large number of red blood corpuscles due to severe bleeding, red blood corpuscles containing their nuclei will be found in the blood, having been thrown in by necessity.

As previously stated, the number of red blood corpuscles in an adult male is about 5,000,000 per c. mm. In females the number is 4,500,000, or 500,000 less. This number will vary under certain conditions. For instance, in a new born child the number per c. mm. is far greater than in the adult.

Altitude greatly influences the number of red blood corpuscles. If a person lives for even a short time in a high altitude, a very marked increase of red blood corpuscles is soon evident. The number may go from 5,000,000 to 8,000,000 per c. mm. These observations have been pointed out by numerous investigators. As the outside pressure of oxygen decreases the bone marrow ressponds by manufacturing more red blood corpuscles to act as carriers of oxygen. This increase does not occur immediately. The first few days, in high altitudes, the increase is rapid, followed by a gradual augmentation through a number of weeks until the required number is reached. It has been pointed out that this increase is so rapid for the first number of days that it cannot be entirely accounted for by the bone marrow, therefore it is supposed that this increase is due to the contraction of the spleen, the emptying of the stagnant capillary areas, or the concentration of the blood plasma due to the increased amount of water present in the tissues.

—*Lloyd Perry*, '47