Everyday in clinical practice, in thousands of blood samples determinations are made of the erythrocyte, platelet, and leukocyte counts and the hematocrit index. For determining the platelet and leukocyte counts, various chemical reagents which deform or destroy the blood cells are used, and this affects the results of the analysis.

During the study of the morphophysiological characteristics of the blood cells, the need arises for obtaining a pure fraction of the leukocytes, platelets, and other cell forms, preserving their physiological, cytochemical, and morphological properties as intact as possible.

Separate cell fractions can be obtained by means of a spiral centrifuge (Fig. 1) which has been developed and produced by the Special Design Office of Biophysical Apparatus and Electronic Machines.

The centrifuge uses the principle of separating citrated blood in a long capillary tube which is bent into a spiral and mounted in the groove of a rotor of the same shape. By having a very long tube (442 mm) for a rotor 150 mm in diameter (Fig. 2), the resolving power of the instrument is increased.

The partition factor \( F_p \) of the spiral centrifuge is determined for each point of the spiral:

\[
F_p = \frac{\omega^2 R}{g \cos \alpha},
\]

where \( \omega = \frac{\pi n}{30} \) (angular velocity per sec); \( n \) represents the number of revolutions of the rotor per minute; \( R \) the distance from the center of rotation of the rotor to the point at which the partition factor is determined; \( g \) (9.81 m/sec\(^2\)) is the acceleration of the Earth’s gravitational force; and \( \alpha \) is the angle between the tangent at each point of the spiral and the radius.

After centrifugation of the blood sample obtained from the finger and diluted (1:4) with 3.8% sodium citrate, the blood cells are distributed in accordance with their specific gravity. Plasma (sp. gr. 1.026...
is found close to the center of the rotor, followed by leukocytes (sp. gr. 1.060-1.065 g/cm$^3$), and finally the heavier cells, namely the erythrocytes and other possible cells (often pathological, with specific gravity 1.09 g/cm$^3$).

In the course of 3-4 min it is possible to determine the number of erythrocytes per mm$^3$ blood, the hematocrit index, and the leukocyte count by means of the spiral centrifuge.

The plastic capillary tube, with an internal diameter of 1 mm and equal in length to the length of the spiral groove of the rotor, is filled with 0.5 ml of the mixture of citrate and blood, knotted at one end, and placed in the rotor groove. The lid is screwed on to the rotor and the assembly mounted on the centrifuge.

After centrifugation for 4 min, a red column of erythrocytes is clearly visible in the tube. The length of this column (in mm), measured along the spiral groove, is the sedimentation value, characterizing the erythrocyte count and the hematocrit index (obtained from a special scale, Fig. 3).

The grayish-white layer of leukocytes can be seen between the columns of erythrocytes and the plasma. To determine the leukocyte count, a piece of the tube 40-50 mm in length, containing the layer of leukocytes, is cut out. A knot is tied at one end of the tube, which is then placed in the straight groove in the rotor lid. The rotor is assembled and fixed to the centrifuge, and the specimen recentrifuged for 4 min. After centrifugation, films are made in the usual way from the collection of leukocytes thus obtained. To investigate a large number of leukocytes and other cells, 5 ml of a blood-citrate mixture (9:1) is prepared. This ratio between blood and citrate prevents injury to the leukocytes and other blood cells. The citrated blood is next centrifuged on any laboratory centrifuge with a partition factor of not less than 500 g for 10 min. A "leukocyte film" (buffy coat) is then clearly visible in the tube between the plasma and red blood.

The "leukocyte film" is removed, plasma is added to it, and a capillary tube is filled with the mixture and centrifuged for 4 min on the spiral centrifuge. A large collection of leukocytes is then visible at the boundary between the plasma and the column of erythrocytes. Next, as in the preceding case, centrifugation is repeated in the lid of the rotor.

If necessary, all the "leukocyte film" can be used for separation of a larger number of leukocytes in a biologically active state and in a pure form.

The number of leukocytes and other blood cells in films made from the buffy coat is many times greater than their number in the peripheral blood. The differential leukocyte count can therefore be carried out much more rapidly and accurately, and cells can be found which are not detectable in preparations taken from patients by the usual methods.

The investigation of leukocytes from the peripheral blood by means of the spiral centrifuge can replace the taking of bone marrow samples.

Two experimental models of the spiral centrifuge have undergone clinical trials at the Institute of Experimental and Clinical Oncology, Academy of Medical Sciences of the USSR, during 1965-66. The erythrocyte count was determined in 500 inpatients, with parallel determinations using the "Celloscope." The discrepancy between the results was $\pm 5\%$. The hematocrit index was determined in 100 patients in parallel.